

Region 10

3.1 LOWER DUWAMISH WATERWAY, SEATTLE, WASHINGTON

3.1.1 List of Commenters/Correspondents

NPL-U34-3-11-1-R10	Comment dated January 16, 2001 from Anne L. Long, Tytanic LLC, Bellevue, Washington
NPL-U34-3-11-2-R10	Comment dated January 16, 2001 from Mike Cassidy, President, Long Painting Company, Seattle, Washington
NPL-U34-3-11-3-R10	Comment dated January 26, 2001 from Kim Maree Johannessen, Johannessen & Associates, P.S., Environmental, Land Use & Regulatory Law, Seattle, Washington
NPL-U34-3-11-4-R10	Comment dated January 25, 2001 from Wm. Roger Truitt of Piper, Marbury, Rudnick & Wolfe, LLP, Baltimore, Maryland, on behalf of Tytanic LLC and Long Painting Company
NPL-U34-3-11-5-R10	Comment dated January 30, 2001 from Penni A. Cocking, President, Duwamish Valley Preservation Coalition, Seattle, Washington
NPL-U34-3-11-6-R10	Comment dated January 30, 2001 from Pam Johnson, Field Director, People for Puget Sound, Seattle, Washington
NPL-U34-3-11-7-R10	Comment dated January 30, 2001 from Sue Joerger, Puget Soundkeeper Alliance, Seattle, Washington
NPL-U34-3-11-8-R10	Comment dated February 14, 2001 from private citizen, Seattle, Washington
NPL-U34-3-11-9-R10	Comment dated February 16, 2001 from Warren Beardsley, CEO, PSF Mechanical, Seattle, Washington
NPL-U34-3-11-10-R10	Comment dated February 2, 2001 from Sue Joerger, Puget Soundkeeper Alliance, Seattle, Washington
NPL-U34-2-11-11-R10	Comment dated February 20, 2001 from Wm. Roger Truitt of Piper, Marbury, Rudnick & Wolfe, LLP, Baltimore, Maryland, on behalf of Tytanic LLC and Long Painting Company
NPL-U34-3-11-12-R10	Comment dated February 24, 2001 from private citizen, Seattle Washington

NPL-U34-3-11-13-R10	Comment dated February 28, 2001 from Craig R. O'Connor, Deputy General Counsel, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of General Counsel, Washington, D.C.
NPL-U34-3-11-14-R10	Comment dated February 28, 2001 from Gregory Baker, Ecologist, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of Resource Conservation and Assessment, Damage Assessment Center, Settle, Washington
NPL-U34-3-11-15-R10	Comment dated February 28, 2001 from Gregory Baker, Ecologist, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of Resource Conservation and Assessment, Damage Assessment Center, Settle, Washington (Reconfirmation letter)
NPL U34-3-11-16-R10	Comment dated February 28, 2001 from Gregory Baker, Ecologist, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of Resource Conservation and Assessment, Damage Assessment Center, Settle, Washington
NPL-U34-3-11-17-R10	Comment dated March 1, 2001 from Glen R. St. Amant, Senior Sediment Specialist, Muckleshoot Indian Tribe - Fisheries Department, Auburn Washington
NPL-U34-3-11-18-R10	Comment dated February 28, 2001 from Mike Cassidy, President, South Park Business Association, Seattle, Washington
NPL-U34-3-11-19-R10	Comment dated March 6, 2001 from Wm. Roger Truitt of Piper, Marbury Rudnick & Wolfe, LLP, Baltimore, Maryland, on behalf of Tytanic LLC and Long Painting Company
NPL-U34-3-11-20-R10	Comment dated March 13, 2001 from Kim Maree Johannessen, Johannessen & Associates, P.S., Environmental Land Use & Regulatory Law, Seattle, Washington
NPL-U34-3-11-21-R10	Comment dated March 6, 2001 from private citizen, Seattle, Washington
NPL-U34-5-11-R10	Correspondence dated October 3, 2000 from The Honorable Gary Locke, Governor of the State of Washington
NPL-U34-5-14-R10	Correspondence dated February 6, 2001 from Wm. Roger Truitt of Piper, Marbury, Rudnick & Wolfe, LLP, on behalf of Tytanic LLC and Long Painting Company

NPL-U34-5-15-R10	Correspondence dated February 14, 2001 from Stephen Caldwell, Acting Director, State, Tribal and Site Identification Center, U.S. Environmental Protection Agency, Washington, D.C.
NPL-U34-5-16-R10	Correspondence dated February 14, 2001 from Stephen Caldwell, Acting Director, State, Tribal and Site Identification Center, U.S. Environmental Protection Agency, Washington, D.C.
NPLU34-5-17-R10	Correspondence dated February 14, 2001 from Stephen Caldwell, Acting Director, State, Tribal and Site Identification Center, U.S. Environmental Protection Agency, Washington, D.C.
NPL-U34-5-18-R10	Correspondence dated February 14, 2001 from Stephen Caldwell, Acting Director, State, Tribal and Site Identification Center, U.S. Environmental Protection Agency, Washington, D.C.
NPL-U34-5-19-R10	Correspondence dated February 14, 2001 from Stephen Caldwell, Acting Director, State, Tribal and Site Identification Center, U.S. Environmental Protection Agency, Washington, D.C.
NPL-U34-5-20-R10	Correspondence dated February 14, 2001 from Stephen Caldwell, Acting Director, State, Tribal and Site Identification Center, U.S. Environmental Protection Agency, Washington, D.C.
NPL-U34-5-21-R10	Correspondence dated March 1, 2001 from Stephen Caldwell, Acting Director, State, Tribal and Site Identification Center, U.S. Environmental Protection Agency, Washington, D.C.
NPL-U34-5-23-R10	Correspondence dated March 14, 2001 from Stephen Caldwell, Acting Director, State, Tribal and Site Identification Center, U.S. Environmental Protection Agency, Washington, D.C.
NPL-U34-5-24-R10	Correspondence dated May 17, 2001 from the Honorable Jennifer Dunn, U.S. House of Representatives, 8 <sup>th</sup> District, State of Washington
NPL-U34-5-25-R10	Correspondence dated August 15 from Christine Todd Whitman, Administrator, U.S. Environmental Protection Agency, Washington, D.C.

### 3.1.2 Site Summary

Sediments in the lower Duwamish River are contaminated with semivolatile organic compounds, PCBs, inorganics, and organotins. The Duwamish River originates at the confluence of the Green and Black Rivers near Tukwila, Washington, then flows northeast for approximately 21 river kilometers, dividing at the southern

end of Harbor Island to form the East and West waterways prior to discharging into Elliot Bay at Seattle, Washington. A segment of the river is maintained by the U.S. Army Corps of Engineers as a federal navigation channel (i.e., the reach downchannel of Turning Basin #3).

The shorelines along the majority of the Duwamish Waterway have been developed for industrial and commercial operations. Much of the upland areas are heavily industrialized. In addition, this reach of the river is the receiving water body for discharges from over 100 storm drains, combined sewer overflows (CSOs), and other outfalls. Historical or current commercial and industrial operations include cargo handling and storage; marine construction; boat manufacturing; marina operations; paper and metals fabrication; food processing; and airplane parts manufacturing. Contaminants may have entered the river via several transport mechanisms, including spillage during product shipping and handling, direct disposal or discharge, contaminated ground water discharge, surface water runoff, storm water discharge, or contaminated soil erosion.

The presence of polychlorinated terphenyl (PCT), polychlorinated biphenyl (PCB), inorganic, semivolatile organic compound, and organotin contamination to surface sediments has been documented in the lower Duwamish River. In addition, subsurface sample results indicate that semivolatile organic compound, inorganic, and organotin contamination exists up to a depth of 1.2 meters (i.e., 4 feet) at some locations within the river. Numerous investigations performed by EPA, the Boeing Company, King County Department of Natural Resources, and the National Oceanographic and Atmospheric Administration (NOAA) have been conducted with varying scopes and have led to the documentation of the contamination in the lower Duwamish River.

The lower Duwamish River is fished for recreational, commercial, and subsistence purposes. Three salmon hatcheries within the Green-Duwamish River system release approximately 10 million juvenile salmon each year. The Duwamish River is part of the traditional fishing grounds for the Muckleshoot and Suquamish Indian tribes. The National Marine Fisheries Service, has conducted numerous studies on the effects of contaminated sediments on biotic resources in the Duwamish River and elsewhere in Puget Sound. This research has shown that juvenile salmon from the Duwamish River exhibit reduced growth and immune system function relative to salmon from uncontaminated areas.

The lower Duwamish River serves as a migratory route, nursery, and osmoregulatory transition zone for several species of Pacific salmon. Puget Sound Chinook salmon are federally listed as threatened and use the lower Duwamish River during a critical stage of their migration from a fresh water to a salt water environment. The federal candidate species Coho salmon also occurs in this area as does a nesting territory for the federal listed threatened Bald eagle and a wetland.

### **3.1.3 Summary of Comments/Correspondence**

The Honorable Gary Locke, Governor of the State of Washington concurred with EPA's decision to place the Lower Duwamish Waterway on the Superfund National Priorities List. Numerous concerned citizens, community groups, coalitions and alliances, and NOAA also supported the listing and identified other possible threats posed by the site not evaluated in the HRS (Hazard Ranking System, 40 CFR 300, Appendix A) scoring. Mr. Glen St. Amant, commenting for the Muckleshoot Indian Tribe, also expressed support for listing and commented that the Tribe expects full involvement in the RI/FS process both in its capacity as a federally-recognized tribe and as a Natural Resource Trustee.



Kim Maree Johannessen of the law firm of Johannessen & Associates submitted comments on behalf of Duwamish Shipyard, Inc. and Northland Services, Inc., hereafter referred to as DSI and Northland. Wm. Roger Truitt of the law firm of Piper, Marbury, Rudnick and Wolfe submitted comments on behalf of Tytanic LLC and Long Painting Company, hereafter referred to as Long Painting and Tytanic. South Parks Business Association, PSF Mechanical, Inc., DSI, Northland, Long Painting and Tytanic opposed the listing, claiming that the EPA had been arbitrary and capricious. Their comments on the proposed listing decision raised similar information access, procedural, policy and technical HRS scoring issues.

DSI, Northland, Long Painting, and Tytanic requested several extensions to the comment period for several reasons, including interruption by holidays and an earthquake, and claiming that the time provided was inadequate to obtain and review all documents used by the Agency in making the listing decision. They objected to a denial of an additional extension request, contending that their FOIA requests had not yet been adequately responded to. They also objected to wording in the Federal Register at the time of proposal requiring that the commenters be specific in their comments and identify what parts of the HRS scoring or policy actions to which the comments refer. They claimed that EPA had failed to consider numerous other investigations performed on the Lower Duwamish by several Government agencies and had failed to provide adequate reference to these investigations for public comment and review. They also claimed that EPA could not proceed with the listing until all information used in or that should have been used in the listing decision were made available and time given for them to have input based on these materials.

South Park Business Association, DSI and Northland commented that contrary to EPA's claims, listing the Waterway is a significant regulatory action under Executive Order 12866 and was not exempt from OMB review. They also asserted that the listing would have a significant effect on small businesses due to the stigma of listing and because it would stop all USACE projects, including dredging of the Waterway. Because of this impact on small businesses, they argued that EPA had failed to adequately comply with the Regulatory Flexibility Act and the Small Business Regulatory Enforcement Fairness Act. PSF Mechanical, Inc. also expressed concern about the impact of listing on small businesses.

DSI, Northland, Long Painting, and Tytanic also asserted that EPA had not met its obligation under the National Environmental Policy Act (NEPA) because the listing was a major federal action with potentially significant consequences.

DSI and Northland commented that it would be appropriate and consistent with EPA's State deferral policy to defer the site to the State of Washington for remediation instead of listing it. DSI, Northland, and South Parks Business Association and PSF Mechanical, Inc. recommended proceeding with the remediation under existing agreements without listing the site on the NPL. Northland and Long Painting and Tytanic asserted that listing the site would be contrary to EPA's RCRA deferral policy, in that several sites on the Waterway were undergoing RCRA corrective action, including sediment contaminant investigations or corrective measures. DSI and Northland also claimed that listing was unnecessary because four parties had already committed to completing a remedial investigation/feasibility study (RI/FS) under both state and federal law in an Agreed Order/Administrative Order On Consent (AOC). They insisted that this AOC was negotiated and then conditioned on the site listing, which is arbitrary and capricious.

DSI, Northland, Long Painting, Tytanic, and Mr. Glen St. Amant, commenting for the Muckleshoot Indian Tribe, commented on the relationship between listing and Natural Resource Damages (NRD) claims. Mr. St. Amant stated that, in the AOC for the RI/FS, the Natural Resource Trustees had not been afforded adequate statute of limitations protection. South Park Business Association, DSI, Northland, Long Painting,

and Tytanic asserted that the only real reason for listing the site was to revive NRD claims, and asserted that this was improper.

DSI and Northland also claimed that listing the site would have a negative impact on cleanup of other NPL sites because the cleanup of the other sites was dependent on the use of sand dredged from the Lower Duwamish Waterway to be used as capping material at these sites. They claimed EPA's failure to consider this impact was arbitrary and capricious.

DSI and Northland asserted that EPA had failed to comply with the National Contingency Plan (NCP) in that it had not performed a PA or prepared a PA report.

Regarding technical HRS scoring issues, DSI, Northland, Long Painting, and Tytanic submitted comments on the identification of observed releases, on identifying the sediments as a single source, and on the assignment of toxicity and bioaccumulation factor values for the site. On the identification of observed releases, they questioned the quality of the data used to identify the releases and claimed that EPA had not adequately explained the use of qualified data. They both commented on the acceptability of the methods used to establish background levels for the site, expressing concern regarding EPA's consistency in following EPA guidance on accounting for particle size and organic content in comparing the background levels to release sample concentrations. They also commented on other similarity factors such as sampling and analysis methods, and the similarity of the sampling times.

DSI and Northland also questioned whether the background sample locations were representative of the conditions upstream of the site, the use of sediment samples to identify releases of organotin, the lack of confirmatory biological testing, and identifying observed releases when the levels were below regulatory limits. They also asserted that EPA should consider how sediment quality had improved over time.

DSI, Northland, Long Painting, and Tytanic argued that it was contrary to EPA regulations and guidance to identify the contaminated sediments as a source, pointing out that the HRS indicates that this should not be done if there is no identified source. They asserted that there were several identified sources of the sediment contamination. They also asserted that EPA guidance states that before identifying a sediment source the equivalent of an expanded SI should be performed, and that this was not undertaken. Related to this, both DSI, Northland, Long Painting, and Tytanic asserted that there was not continuous contamination throughout the waterway, but hot spots, and that EPA needed to show each hot spot qualified independently for the NPL.

DSI and Northland questioned the assignment of the toxicity value for PCBs, stating that the value was based on flawed and outdated information and asserted that EPA should refine the bioaccumulation value used in the scoring to reflect site-specific EPA studies performed at a nearby site.

Jennifer Dunn, a member of the U.S. House of Representatives from the 8<sup>th</sup> District, State of Washington, raised a number of issues identified by other commenters. She received a response from Christine Todd Whitman, EPA Administrator, and all of the issues raised in her correspondence are addressed in this support document.

### **3.1.3.1 Request for Extension**

DSI and Northland asserted that the length of the comment period (60 days) was inadequate due to the thousands of pages of technical information the public was expected to review in a short time, which also was

hampered by federal holidays, holiday vacations, and lack of access to a full and complete documentation record during this time frame. A 90-day extension was requested by DSI, Northland, Long Painting, and Tytanic (As explained below, EPA granted a 30-day extension.). DSI and Northland claimed that EPA did not inform them of a decision to grant or deny the extension. They also argued that the 30-day extension which was granted was contrary to EPA's actions at other sites that have been proposed for listing on the NPL. In addition, DSI and Northland renewed their request for an additional 60 days in which to submit comments. DSI and Northland stated that they "reserve the right to submit additional comments after they have had an adequate opportunity to review and analyze all relevant information in the DR [HRS documentation record], including EPA and Washington Department of Ecology . . . files relating to the Waterway, the individual HRS [Hazard Ranking System, 40 CFR 300, Appendix A] factor values, and other listing eligibility criteria."

DSI and Northland also asserted that "EPA's edict in the December 1, 2000 Federal Register that it 'will not address . . . comments that are not specifically cited to by page number and referenced to the HRS or other listing criteria' and that it 'will not address comments unless they indicate which component of the HRS documentation record or what particular point in EPA's stated eligibility criteria is at issue' is arbitrary and capricious in light of EPA's failure to provide sufficient time to review the DR and provide meaningful commentary." DSI and Northland argued that EPA is required to consider all public comments submitted on a listing decision, and not merely those that cite the HRS documentation record by page number and reference.

Long Painting and Tytanic also stated that they reserve their right to modify or supplement their comments. They also renewed their request for a 60-day extension, or at least a 30 day extension. DSI and Northland also renewed their request for an additional 60 days in which to submit comments.

Long Painting and Tytanic claimed that, in a letter dated February 14, 2001, EPA provided the basis for granting a 30-day extension which was due to docket issues raised by Long Painting and Tytanic. Long Painting and Tytanic argued that EPA's explanation did not address the size or complexity of the HRS documentation record, nor did it explain why it had granted 60-day and 90-day extensions in other similar cases (e.g., Kennecott North and South Zones and Normandy Park Apartments) while refusing to do so with respect to this site.

Long Painting and Tytanic requested another extension and noted that their previous request was denied because "EPA's policy is to extend the comment period only in cases where the materials placed in the docket were incomplete or otherwise not in order." Long Painting and Tytanic stated that documents (obtained pursuant to a Freedom of Information Act (FOIA) request) should have been included in the NPL docket. Long Painting and Tytanic specifically mentioned documents regarding RCRA corrective action sites and documents which Long Painting and Tytanic requested under FOIA, and suggested that other documents responsive to the FOIA requests it has submitted to EPA, the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Fish and Wildlife Service (USFWS) will likely reveal information that should have been considered by EPA in connection with its listing decision. Long Painting and Tytanic also stated that EPA Headquarters only delivered one document under the FOIA request.

Long Painting and Tytanic stated that "[i]t is a well-accepted principle that notice and comment rulemaking requires an Agency to identify and make available the data that it has considered in reaching a decision to propose a particular rule in order to permit interested parties to provide 'meaningful commentary.'" Long Painting and Tytanic also argued that EPA cannot issue a final rule for this site because it has failed to make available for public comment all information it has or should have considered in making the listing decision.

Therefore, they stated that it is inappropriate for the Agency to close the comment period without making such records available for an adequate period of time to allow for meaningful input by Tytanic and Long Painting.

In response, extensions to public comment periods are granted or denied based on the individual circumstances in each proposed listing. In this case, a thirty (30) day extension was granted on the basis of minor discrepancies in docket materials. In addition, in a letter from Steve Caldwell (Acting Director, State, Tribal and Site Identification Center) to Wm. Roger Truitt (representing Long Painting and Tytanic), dated March 1, 2001, EPA explained the 60- to 90-day extensions of the comment period for the two sites, Kennecott North and South Zones and Normandy Park Apartments, cited by Mr. Truitt:

These sites were proposed to the NPL in January 1994 and February 1995, respectively. In the case of the Kennecott sites, EPA granted two extensions totaling 90 days in all due to numerous errors or inconsistencies in the public docket materials. In the case of the Normandy Park Apartments, the Agency did grant two extensions of the comment period because of delays in providing materials. However, both sites were proposed to the NPL before EPA implemented procedures to streamline the NPL listing process (See, e.g., 63 Fed. Ref 11340-45 (March 6, 1998)). Over the past few years, EPA has implemented steps to reduce significantly the time required to complete the NPL listing process. This is one of the many ways the Agency is reducing the amount of time required to identify, evaluate, and clean up sites that warrant remedial action. One of the steps EPA has taken is to implement the streamlining policy discussed above on extensions to the comment period. In the case of this listing, a 30 day extension was granted because of confusion with docket materials and then a 5 day extension was granted due to an earthquake which hit Seattle on February 28, 2001.

Additionally, as part of the streamlining policy mentioned in the March 1, 2000 letter to Wm. Roger Truitt, EPA generally will not extend the comment period to allow for review of materials that are not considered in scoring a site under the HRS.

EPA's response to commenter's claim that EPA did not consider documents which were discovered under FOIA is addressed in Section 3.1.3.1.1 of this document.

In response to DSI and Northland's claim that it was not contacted by EPA regarding the extension request, EPA did mail a formal letter on February 14, 2001, explaining that the a 30-day extension had been granted. This piece of mail was returned to EPA on March 8, 2001 by the post office with a "return to sender" stamp. However, an EPA Region 10 staff person had orally told DSI and Northland about the extension. In addition, the EPA Region 10 Community Involvement Office mailed postcards on February 5, 2001, to DSI, Northland, and approximately 745 other people indicating the public comment period for the Lower Duwamish Waterway site had been extended to March 1, 2001.

With respect to commenter's concern that EPA must respond to all comments regardless of whether they meet the requirements set out in the December 1, 2000 Federal Register notice for the proposed rule, the language set out in the Federal Register is intended to ensure that commenters explain how the comments are relevant to the scoring of the site so that EPA can adequately respond to comments. As noted by the U.S. Court of Appeals for the D.C. Circuit in *Northside Sanitary Landfill v. Thomas*, 849 F. 2d. 1516, 1519 (D.C.Cir, 1998), commenters have "responsibility for flagging the relevant issues which its documentary submissions presented. . . . '[C]omments must be significant enough to step over a threshold requirement of

materiality before any lack of Agency response or consideration becomes a concern. The comment cannot merely state that a particular mistake was made. . . ; it must show why the mistake was of possible significance in the results . . .” In any event, EPA has responded to all comments submitted during the comment period.

Regarding DSI's, Northland's, Long Painting's, and Tytanic's request for an additional extension, as stated in the March 1, 2001 letter sent to Wm. Roger Truitt from Stephen Caldwell, "EPA has determined an additional extension of the comment period is unnecessary . . . [T]here were two docket issues regarding the map folio which justified the 30 day extension . . . EPA considers the additional 30 days an adequate period of time for the delay relating to the map folio . . . [A]ll the documents EPA relied on for the proposal are available in the public docket . . ."

### **3.1.3.1.1 Failure to Consider All Available Data**

DSI and Northland claimed that EPA failed to consider the numerous past investigations that have been completed on the Waterway and failed to provide adequate references to those investigations in order to make them available for public comment and review. DSI and Northland asserted that EPA failed to consider technical data and information that were critical to evaluating the adequacy and correctness of the HRS score. DSI and Northland noted that the HRS documentation record states "[n]umerous past investigations within the Duwamish Waterway have been conducted with various scopes." DSI and Northland argued that neither the HRS documentation record nor the citation for the statement above (HRS documentation record Reference 4, p. 8) identifies the past investigations by name or property. Lastly, DSI and Northland asserted that EPA deprived the public of an opportunity to review and comment on all the technical information that has been considered, or that should have been considered, by EPA in assessing the relative degree of risk posed by sites that are candidates for the NPL.

Long Painting and Tytanic stated that certain documents obtained pursuant to a FOIA request should have been included in the NPL docket. Long Painting and Tytanic specifically mentioned documents regarding RCRA corrective action sites and documents which Long Painting and Tytanic requested under FOIA and suggested that other documents responsive to the FOIA requests it has submitted to EPA, NOAA, and USFWS will likely reveal information that should have been considered by EPA in connection with its listing decision. Long Painting and Tytanic also asserted that requested records include technical data and information that is critical to evaluating the efficacy of EPA's HRS scoring for the Lower Duwamish Waterway. Long Painting and Tytanic also stated that EPA Headquarters only delivered one document under the FOIA request .

In response, the record for listing includes materials the Agency relied on to score the site under the HRS. ~~None of the materials that were provided in response to the FOIA request were used to support the scoring of the site.~~ Although those materials may pertain to the site in general, they were not used to document the HRS score nor do they undercut EPA's scoring of this site under the HRS.

EPA disagrees with DSI and Northland regarding the failure to consider numerous past investigations. The HRS documentation record itself provided data from the SI, Phase I Site Characterization, and Duwamish Waterway Sediment Characterization Study which were performed by EPA, the Boeing Company, and NOAA, respectively. These studies are HRS documentation record Reference 4 (EPA), 7 (Boeing), and 8 (NOAA). In addition, on page 44 of the HRS documentation record, EPA noted that King County completed a Combined Sewer Overflow Water Quality Assessment for the Duwamish River and Elliot Bay in 1998.

Volume 1 of that report is HRS documentation record Reference 17. DSI and Northland did not specify which specific reports EPA should have considered or specify how such consideration should have changed EPA's evaluation of the site, and, thus, EPA is unable to comment on any particular report of concern to the commenter. With respect to Long Painting and Tytanic's claim that EPA should have considered certain RCRA corrective action documents, Section 3.1.3.6 of this support document; RCRA Deferral, discusses why the RCRA documents do not contain material that affect the listing of this site. With respect to Long Painting and Tytanic's claim that EPA should have considered certain other documents that were obtained pursuant to the FOIA request and that documents requested include technical data and information that is critical to evaluating the efficacy of EPA's HRS scoring for the Lower Duwamish Waterway, to the extent that commenters have specified the documents the Agency should have considered and how they should have affected the scoring of the site, EPA has responded to such comments in other section of this support document (for example, Section 3.1.3.13, Identification of a Contaminated Sediment Source, responds to arguments that certain documents should have been used to attribute releases in the waterway to sources.) EPA is not able to respond to vague speculation that other documents responsive to the FOIA requests submitted to EPA, NOAA, and USFWS will likely reveal information that should have been considered by EPA in connection with its listing decision. EPA notes that EPA completed its response to the FOIA March 30, 2001.<sup>1</sup>

EPA disagrees with the Long Painting and Tytanic's claim that EPA Headquarters (HQ) only delivered one document pursuant to the FOIA request. The HQ response included 47 pages of materials from a number of documents that were in the HQ files (no materials were withheld). As noted in a letter to Long Painting and Tytanic's counsel (Mr. Truitt) accompanying the HQ FOIA response, EPA consulted with Mr. Truitt concerning the documents available at HQ that would be responsive to the FOIA request in a February 26, 2001 telephone conversation with the Superfund Office and Office of General Counsel staff. Mr. Truitt agreed to the approach proposed and followed for the HQ response to the FOIA request.

### **3.1.3.2 Executive Order 12866**

DSI and Northland argued that contrary to EPA's claims, listing the Waterway on the NPL is a significant regulatory action under Executive Order 12866 (E.O. 12866) and is not exempt from OMB review. DSI and Northland pointed out that under E.O. 12866, a significant regulatory action is defined as "one that is likely to result in a rule that may: . . . adversely affect in a material way . . . a sector of the economy...or raise novel legal or policy issues arising out of legal mandates . . ." DSI and Northland claimed that EPA summarily concluded that the OMB has exempted this regulatory action from E.O. 12866 review and that EPA is required under E.O. 12866 to prepare a written statement and cost-benefit analysis for its listing decision and to submit it for OMB review.

DSI and Northland asserted that the listing will adversely affect in a material way the marine transportation and ship repair sectors of the economy due to the dependence of these businesses on the navigability of the

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<sup>1</sup>Pursuant to the FOIA request submitted on behalf of Tytanic and Long Painting, one copy of documents totaling 2,134 pages was provided by EPA Region 10 to Tytanic and Long Painting on February 23, 2001. On March 14, 2001, an additional 110 pages were provided by EPA Region 10 to Tytanic and Long Painting. The FOIA request was completed in EPA Region 10 on March 30, 2001. On February 28, 2001, after earlier discussions with counsel for Tytanic and Long Painting, EPA Headquarters provided a facsimile of information regarding extensions granted during previous public comment periods for NPL sites. On March 14, 2001, EPA Headquarters completed the FOIA request and provided additional documents to Tytanic and Long Painting.

Waterway. DSI and Northland also argued that Northland relies on the USACE issued permits for maintenance activities such as piling replacement and/or rehabilitation. Delays in these maintenance activities could compromise the safety of their operations.

DSI and Northland claimed that listing the Lower Duwamish Waterway site on the NPL raises a novel legal and policy issue; namely, should listing be done for the sole purpose of reviving natural resource damage claims.

In response, it has been determined that this action is not a “significant regulatory action” under the terms of Executive Order 12866 and is, therefore, not subject to OMB review.

As the proposed rule states:

The Order defines “significant regulatory action” as one that is likely to result in a rule that may: (1) Have an annual effect on the economy of \$100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities; (2) create a serious inconsistency or otherwise interfere with an action taken or planned by another Agency; (3) materially alter the budget impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or (4) raise novel legal or policy issues arising out of legal mandates, the President’s priorities, or the principles set forth in the Executive Order. (65 FR 75215)

The listing of this site is not a significant regulatory action. The listing of sites on the NPL does not impose any obligations on any entities. The listing does not set standards or a regulatory regime and imposes no liability or costs. Any liability under CERCLA exists irrespective of whether a site is listed. Further, as explained in Section 3.1.3.3 of this document, the listing of this site will not prohibit the issuance of USACE permits and/or dredging. Therefore, listing does not adversely affect in a material way the marine transportation and ship repair sectors of the economy in the manner suggested by DSI and Northland.

In addition, as explained in section 3.1.3.8 of this support document, this listing does not raise novel policy or legal issues.

### **3.1.3.3 Effect on Small Businesses**

DSI and Northland asserted that small businesses, including DSI and Northland, will be severely damaged by a final listing’s impact on the following: property values; their survivability as small businesses as a result of any potential liability determination; their ability to conduct work under previously issued USACE permits; and the stigma and other EPA-imposed limitations on the transfer of properties located within the boundaries of an NPL site. In addition, DSI and Northland stated that EPA considers DSI and Northland to be potentially responsible parties in connection with contamination in the Waterway.

DSI and Northland claimed that listing the Waterway on the NPL could result in a cessation of all maintenance dredging. DSI and Northland asserted that USACE regulations restrict maintenance dredging at NPL sites. In addition, DSI and Northland claimed that the USACE has already advised EPA, in a letter dated October 13, 2000, that listing the Waterway, specifically the stretch from the turning basin to the First Avenue South Bridge, will deny their ability to dredge the river under USACE policy. This letter (Exhibit D

of DSI and Northland comments) was sent from the Colonel of the Seattle District Army Corps of Engineers to Chuck Finley, Acting Regional Administrator for EPA Region 10. The letter was a response to EPA providing the USACE the opportunity to review the Agreed Order/Administrative Order on Consent (AOC) for the Remedial Investigation/Feasibility Study (RI/FS) of the Lower Duwamish Waterway site. This letter was written prior to the proposal of the Lower Duwamish Waterway site to the NPL. DSI and Northland argued that EPA failed to respond to the USACE's substantive comments.

DSI and Northland stated that the USACE's comments highlighted the negative impact that any listing decision would have on USACE projects that are in various stages of completion. DSI and Northland claimed that Northland would suffer enormous impact from the NPL listing as a result of its inability to conduct work that had been previously authorized under USACE-issued permits. They stated that on January 19, 2001, the USACE issued permits to Northland and stated that the "project must comply with certain conditions, including the condition that [n]o work is done in or adjacent to (within 300 linear feet) an existing or previously designated Superfund Cleanup site or a site currently or previously designated for cleanup under the Washington State Model Toxic Control Act" (see commenter's Exhibit E). DSI and Northland argued that, as a result, it appeared that the USACE policy prohibits Northland from completing maintenance activities on its piers.

DSI and Northland stated that hundreds of marine and water dependent businesses line the shorelines of the Waterway and depend on the ability of vessels to reach their piers and docks. DSI and Northland concluded by stating that marine construction businesses who depend on in-water repair and maintenance projects, including maintenance dredging, will be adversely impacted by a decision to list the Waterway on the NPL.

In response, with respect to the DSI and Northland comment on USACE policy regarding dredging within boundaries of NPL sites, USACE policy concerning such dredging was revised on April 25, 2001 to permit such dredging. Specifically, revised Policy Guidance Letter 49 provides that such dredging may occur if USACE obtains reasonable protection from liability and consults with EPA, non-federal interests, and potentially responsible parties. Revised Policy Guidance Letter 49 is included as Attachment A to this support document.

Moreover, the January 19, 2001 correspondence from the USACE to Northland does not prohibit work such as piling replacement in a Superfund site. As stated in Exhibit F of the comments submitted by DSI and Northland (e-mail from Ann Uhrich, U.S. Army Corps of Engineers to Ann Costanza, Anchor Environmental dated January 31, 2001), permits for activities related to remediation of Superfund sites are required to be submitted to EPA for consideration. As stated in Exhibit E of the comments submitted by DSI and Northland, USACE will issue permits within Superfund sites for repair and maintenance activities (i.e., not related to the remediation of the Superfund site); however, consultation with USFWS and the National Marine Fisheries Service for compliance with the Endangered Species Act is required. The correspondence Northland provided does not establish that they will not be able to perform the maintenance and repair work they would like to complete.

Whether EPA has already begun to identify PRPs other than the four who have signed the AOC is irrelevant to listing the Lower Duwamish Waterway site on the NPL. Furthermore, as stated in 65 FR 75215, "The listing imposes no liability. . . . Whether an entity, small or otherwise, is liable for response costs for a release of hazardous substances depends on whether that entity is liable under CERCLA 107(a). Any such liability exists irrespective of whether the site is listed on the NPL (65 FR 46135 (July 27, 2000))."



### **3.1.3.3.1 Regulatory Flexibility Act and Small Business Regulatory Enforcement Fairness Act**

DSI and Northland argued that EPA has failed to analyze the effect of proposing the Waterway for listing on small businesses. DSI and Northland stated that, pursuant to the Regulatory Flexibility Act (RFA), whenever an Agency is required to publish a notice of rulemaking for any proposed or final rule, it must prepare and make available for public comment a regulatory flexibility analysis that describes the effect of the rule on small entities. DSI and Northland took issue with both the language in the Federal Register (65 FR 75219-75220) and in the HRS documentation record, which they asserted seem contradictory to each other. DSI and Northland asserted that the HRS documentation record references numerous businesses and individuals, and the responsiveness summary for the AOC and the RI/FS stated that “Ecology and EPA agree [that] [m]any small businesses that may be responsible for some of the costs in cleaning up the site are not represented in the current negotiations for this site [and that] EPA has a duty to make sure that large businesses do not shift their responsibility onto the small businesses.”

The South Park Business Association asked EPA to conduct, under the RFA, an analysis of the effect of this rulemaking on small businesses and make the analysis available to the public. It also disagreed with EPA’s statements in the Federal Register, proposing the listing.

PSF Mechanical stated that, “if the area is listed as a Superfund site, it will become a legal, administrative and costly burden, especially on the small businesses and landowners caught in the government regulator web that follows all federal projects.”

DSI and Northland stated that there are hundreds (if not thousands) of residences, individual property owners and small businesses located along the banks of the Waterway and within the Waterway’s drainage area. DSI and Northland asserted that NPL listing will most certainly encompass all properties and sediments in and contiguous to the Waterway, and, at the very least, the properties along, in the vicinity of, and within the drainage basin of the Waterway will become difficult to sell or lease if they are tainted by a broader than necessary Superfund designation.

DSI and Northland claimed that the average capital cost of cleaning up a non-federal Superfund site is \$21.8 million. DSI and Northland quoted statements made by State officials in editorials appearing in the *Seattle Times* (November 12, 2000) that the cleanup of the proposed Duwamish Waterway site is expected to cost up to \$100 million and take years to complete. DSI and Northland stated that a Superfund action draws numerous law firms into the process and that legal fees will likely total millions of dollars. DSI and Northland stated that the U.S. Court of Appeals for the District of Columbia noted “harmful effects of being linked to a site placed on the NPL, including damage to business reputation, loss of property value and other considerable costs.”

Long Painting and Tytanic also took issue with the proposed rule as published in the Federal Register on December 1, 2000, which indicated that the proposed rule did not require a regulatory flexibility analysis. Long Painting and Tytanic stated that two court cases (*Mead Corporation v. EPA*, No. 95-1610 (D.C. Cir., 1996) and *Board of Regents of the University of Washington v. EPA*, 86 F.3d 1214, 1217 (D.C. Cir., 1996)) have indicated that placing a site on the NPL has impact on businesses. Specifically, “the circuit has clearly recognized the harmful effects of being linked to a site placed on the NPL, ...[including] (damage to business reputation, loss of property value and other considerable costs).” (100 F.3d at 1555) In addition, Long Painting and Tytanic stated that, given the “severe consequences for affected parties” that a listing

decision may bring about, it is inappropriate for EPA to side-step the requirements of the RFA by concluding that such consequences with regard to small entities are “hard to predict.”

Long Painting and Tytanic asserted that EPA has identified a large number of small businesses and property owners adjacent to the Waterway who are likely to be significantly affected by a final listing decision. Included in this group is Tytanic, which estimates that listing the Waterway will result in a five percent or more decrease in annual revenue due to loss of business, decreased property values, and expenses incurred in defending cost recovery and natural resource damage claims. Long Painting and Tytanic claimed that listing the Waterway will have negative economic impacts on navigation and commerce in the Waterway due to USACE restrictions on dredging within Superfund sites. Long Painting and Tytanic concluded by asserting that there is no indication in the record that EPA considered the impact of this significant economic factor on small entities.

In response, the listing of this site on the NPL will not impose any obligations on small entities or any other identifiable group. Furthermore, the listing of this site establishes no standards or regulatory regime that any small entity must meet. The listing will impose no liability or direct costs on any small entity. Whether an entity, small or otherwise, is liable for response costs for a release of hazardous substances depends on whether that entity is liable under CERCLA 107(a). Any such liability exists no matter whether the site is listed on the NPL. The courts consistently have held that the RFA does not require EPA to assess the impact of its rule on small entities that are not subject to the rule (*Michigan v. EPA*, 213 F.3d 663, 688-89 (D.C. Cir. 2000); *Motor & Equip. Mfrs. Ass’n v. Nichols*, 142 F.3d 449, 467 (D.C. Cir. 1998); *Mid-Tex Elec. Coop. v. FERC*, 773 F.2d 327, 342 (D.C. Cir. 1985)). Therefore, this listing does not have a significant impact on a substantial number of small entities, and a regulatory flexibility analysis is not required.

Moreover, as discussed above, USACE policy no longer restricts dredging at NPL sites and USACE does not prohibit maintenance activities on piers within Superfund sites. Therefore, adverse impacts to businesses along the Waterway raised by commenter that would be due to the cessation of dredging and inability to conduct maintenance activities are not likely.

### **3.1.3.4 NEPA Compliance**

DSI, Northland, Long Painting, and Tytanic argued that EPA has not complied with its obligation under the National Environmental Policy Act (NEPA) to consider the environmental consequences of the proposed addition of the site to the NPL. DSI, Northland, Long Painting, and Tytanic claimed that EPA must prepare an environmental assessment to ascertain whether the environmental impacts from the proposal would be “significant.” DSI, Northland, Long Painting, and Tytanic asserted that NEPA clearly applies to EPA’s proposed addition of the Waterway to the NPL because the proposed listing is a “federal action.” DSI, Northland, Long Painting, and Tytanic argued that “[r]ulemaking proceedings of all types are federal actions that require preparation of an environmental impact assessment (See *e.g., Calvert Cliffs’ Coordinating Committee, Inc. v. Atomic Energy Commission*, 449 F.2d 1109 (D.C. Cir. 1971)).”

DSI, Northland, Long Painting, and Tytanic stated that the proposed listing is a “major” federal action with potentially significant consequences, and listing is the first step of an inexorable process that has significant environmental impacts. Commenters claimed that listing will result in cessation of USACE dredging activities and maintenance and repair activities on the waterway and cited *Mead Corporation v. Browner* (100 F.3d 152, 155 (D.C. Cir. 1996)). In *Mead*, the Court stated that “Although EPA does not necessarily initiate a cleanup action just because a site is listed . . . listing drastically increases the chances of costly activity.” DSI,

Northland, Long Painting, and Tytanic, therefore, concluded that EPA must prepare an environmental assessment and weigh potential alternatives to NPL listing. DSI and Northland argued that the scoring of a site for addition to the NPL is not the “functional equivalent” of an environmental assessment.

In response, the Agency notes that the NPL is used primarily for informational purposes. Although the NCP at 40 CFR 300.425(b)(1) (55 FR 8845, March 8, 1990) limits use of the CERCLA Trust Fund to remedial actions at sites on the NPL, the listing itself does not determine liability, nor does it represent a finding that remedial action is necessary or will be taken. Decisions on actually conducting response actions are made during the RI, when more information is collected. Thus, the listing process itself does not constitute a “major Federal action” within the context of the National Environmental Policy Act (NEPA).

Moreover, a number of courts have held that, where the authorizing federal statute already provides for a detailed analysis of impacts on the environment, an environmental impact statement (EIS) under NEPA is not required. See State of Alabama v. EPA, 911 F.2d 499 (11<sup>th</sup> Cir. 1990); Merrell v. Thomas, 807 F.2d 776 (9<sup>th</sup> Cir. 1986). Therefore, NEPA generally does not apply to CERCLA-related remedial activities because EPA conducts a thorough review of remedial alternatives and environmental factors during the FS and during the formal selection of a CERCLA remedy; this latter activity is accompanied by public participation requirements. Thus, CERCLA remedial actions qualify for the “functional equivalent” exception to the EIS requirement. See Opinion of EPA Office of General Counsel, “Applicability of Section 102(2)(C) of the National Environmental Policy Act of 1969 to Response Activities Under Section 104 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980” (September 1, 1982).

The commenter claims that “listing is the first step of an inexorable process that has significant environmental impacts.” EPA disagrees. In support of its claim, the commenter cites *Mead Corporation v. Browner*, 100 F.3d 152, 155 (D.C. Cir. 1996). Mead, however, does not stand for the proposition that the NPL listing automatically or inevitably leads to significant environmental impacts: rather, the case recognizes that listing on the NPL “drastically increases the chances of costly activity” and liability for potentially responsible parties. Further, as discussed in section 3.1.3.3 of this support document, commenters claim that listing will inevitably cause USACE to cease navigational dredging and to disallow maintenance and repair activities is not accurate.

Regarding the commenter’s assertion that courts have mandated compliance with NEPA based on the possibility of future impacts of an Agency’s planning decision, the factual and legal circumstances in the cases the commenter cited are clearly distinguishable from the circumstances surrounding an NPL listing. In *Idaho Conservation League v. Mumma*, the National Forest Management Act and the Forest Service regulations governing preparation of land and resource management plans required such plans to be accompanied by an EIS (956 F.2d 1508, 1511 (9<sup>th</sup> Cir. 1992)). The court’s holding in Mumma related not to whether NEPA applied, but rather to whether plaintiffs had standing to challenge the underlying land management plan. Similarly, the issue in *Sierra Club v. Marita* related to whether the plaintiffs had standing to challenge the programmatic forest management plan, not to whether the Forest Service was required to comply with NEPA. Furthermore, in assessing whether the plaintiffs had standing to challenge the forest management plans (that by statute were required to be accompanied by an EIS), the court pointed out that the plans “establish management standards . . . [d]etermine resource management practices, levels of resource production and management, and the availability and suitability of lands for resource management . . . The plans clearly require certain projects to be undertaken and indicate what their effects may be.” Id. At 612. Thus, even if the cases cited by commenter did stand for the proposition that forest management plans would

be subject to NEPA, even absent the statutory or regulatory requirement subjecting them to NEPA, forest management plans are distinguishable from NPL listings. Unlike forest management plans, NPL listings do not establish any requirements or management standards.

### 3.1.3.5 State Deferral

DSI and Northland argued that the most appropriate avenue for addressing these sites identified by EPA as hotspots is under the Model Toxics Control Act (MTCA). DSI and Northland claimed that Washington has sediment management standards designed to deal specifically with sites with potentially impacted sediments. DSI and Northland stated that the Waterway is already listed as a contaminated sediment site under MTCA. DSI and Northland asserted that listing the Waterway on the NPL would be contrary to EPA policy and would add further delay to the cleanup process. DSI and Northland asserted that “it is well documented that cleanups at federal Superfund sites are plagued by delay.” In support, DSI and Northland cite several Government Accounting Office (GAO) studies which identified that the cleanup of sites completed in fiscal year 1996 took 10.6 years (GAO/RCED-97-20, March 31, 1997), and sites listed between 1986 and 1994 will take more than 8 years to complete cleanup (GAO/RCED-97-238R, September 24, 1997). DSI and Northland also provided the Commencement Bay Nearshore/Tideflats Superfund site as an example of a site which was placed on the NPL in 1983 and cleanups at four of the six waterways are still not completed. DSI and Northland asserts that given Ecology’s participation in efforts to move toward cleanup in the Waterway, CERCLA’s history of delay and inefficiency, and EPA’s State Deferral Policy, listing the Waterway on the NPL would be arbitrary and capricious.

PSF Mechanical stated that, instead of listing the site, “[i]t would be a much better solution to foster and encourage the existing plan,” referring to the public/private partnership already proposed to move forward the cleanup of the Waterway.

In response, EPA finds that PSF Mechanical, DSI and Northland’s suggestion to defer the site to the state would not be consistent with EPA’s guidance because the state did not request for the site to be deferred. EPA’s policy concerning deferral to states provides that, generally, deferral of a site to a state is appropriate only if the state requests the deferral. On page 4 of OSWER Directive 9375.6-11, *Guidance on Deferral of NPL Listing Determinations While States Oversee Response Actions*, a discussion of a site’s eligibility for deferral states that “the State must express interest in having the site deferred to it for response. The State and EPA also should agree that the State will address the deferred site sooner than, and at least as quickly as, EPA would expect to respond.” In the present case, no such interest has been expressed; rather, the contrary has occurred. EPA received a letter from Governor Gary Locke of the State of Washington dated October 3, 2000 supporting the listing of the Lower Duwamish Waterway site on the NPL. In that letter, Governor Locke states, “. . . I believe it is appropriate to place the Waterway on the NPL, and I concur with EPA’s proposal to move forward with listing.”

Thus, it is clear from the Governor’s statements that the state does not want the site deferred to it. In fact, the letter states, “I appreciate EPA’s efforts in working with the state on this site and I look forward to our continued progress.”

Regarding the commenter’s claim that NPL listing causes delay, the commenters have given no evidence, and EPA is unaware of any, to support their speculation that the listing would have various adverse effects on environmental cleanup. DSI and Northland discuss the length of cleanup at Superfund sites; however, the commenters failed to demonstrate that environmental cleanup is achieved quicker at non-NPL or comparable

sites. EPA does not think it appropriate to delay addressing the health and environmental issues presented by the site based on mere speculation. The NPL serves primarily as an informational list. Inclusion of a site or facility on the list reflects EPA's judgment that a significant release or threat of release has occurred, and that the site is a priority for further investigation under CERCLA. Furthermore, the focus of the CERCLA program is to identify and, where necessary, address hazardous substances releases that may pose a threat to health or the environment.

### **3.1.3.6 RCRA Deferral**

DSI, Northland, Long Painting, and Tytanic asserted that EPA had failed to apply its RCRA deferral policy to the Lower Duwamish Waterway. DSI and Northland asserted that "[t]here are at least four separate RCRA sites undergoing corrective action within the tentative boundaries of this proposed NPL site." DSI and Northland stated that EPA has a policy not to list sites on the NPL that are currently undergoing corrective action under RCRA. The four sites DSI and Northland identified include the Boeing Plant 2 facility, the Rhone-Poulenc facility, the Boeing Development Center, and the Philip Services Corporation's Georgetown facility. Long Painting and Tytanic stated that there were "numerous facilities which are already subject to RCRA corrective action" and identified three facilities that were undergoing sediment contamination investigations or corrective measures pursuant to EPA corrective action authority and the State of Washington EPA-authorized equivalent: the Boeing Plant 2 facility, the Rhone-Poulenc Marginal Way facility, and the Boeing Development Center.

- **Boeing Plant 2**

DSI and Northland commented that "recent investigations at the Boeing Plant 2 facility have documented significant PCB releases to the Waterway and sediments" (citing Reference 11, page 2 of the HRS documentation record at proposal). DSI and Northland and Long Painting and Tytanic noted that under an AOC with EPA Region 10 under RCRA, since 1994, Boeing has funded extensive investigations of the sediments along Plant 2, and that the sediment investigated includes an area of the waterway more than 3800 feet by 120 feet. DSI and Northland pointed out that in 1999, EPA approved a dredging and capping remedy for 10.5 acres of this sediment, and this remedy is in the design phase and Boeing anticipates its implementation in 2002. DSI and Northland also asserted that in addition to this approved remedy, Boeing has already removed "hotspot" sediments from two areas adjacent to "Outfall 12" and the "Underfall Flume." DSI and Northland stated that regardless of these actions, the proposed NPL listing includes these areas already cleaned up or where the cleanup has been approved by EPA. Long Painting and Tytanic pointed out that the corrective action is discussed briefly in the reference documents to the HRS documentation record.

- **Rhone-Poulenc Marginal Way Facility**

DSI, Northland, Long Painting, and Tytanic identified the Rhone-Poulenc Marginal Way facility as "being administered under an EPA Region 10 AOC pursuant to RCRA" since 1993. Long Painting and Tytanic asserted that under the AOC Rhone-Poulenc is required to investigate discharges of contaminated groundwater and surface water to the Waterway and sediments. DSI and Northland stated that "Rhone-Poulenc has conducted investigations of discharges of contaminated groundwater and surface water to the Duwamish Waterway

and sediments which are adjacent to its outfalls, catch basins, and manholes.” Long Painting and Tytanic also claimed that Rhone-Poulenc has submitted a plan to perform an interim measure to prevent the migration of contamination into the Waterway and will soon begin to study other corrective measures.

- Boeing Development Center

DSI, Northland, Long Painting, and Tytanic pointed out that Boeing has voluntarily entered the Washington State RCRA corrective action clean-up program in 1999 to deal with its Boeing Development Center site. DSI and Northland asserted that “[u]nder the state program, Boeing has agreed to investigate and clean up contaminated sediments and other contamination in the Waterway that pose a threat to public health or the environment.” Long Painting and Tytanic claimed that Boeing already has begun evaluation of sediment contamination in the Waterway adjacent to this facility.

- Philip Services Corporation, Georgetown Facility

DSI and Northland commented that Philip Services Corporation, Georgetown facility “is undergoing investigations, with a Draft RCRA Facility Investigation Report due to be submitted to EPA in June 2001,” and that “[o]n February 16, 2001, the *Seattle Times* quoted EPA’s officials and indicated that the plume of contaminated groundwater from the facility is thought to be affecting the Waterway.” DSI and Northland submitted a newspaper article in support of this statement.

Long Painting and Tytanic commented that, according to an EPA email, Philip Services was not being considered part of the Waterway site because it was “being handled as a separate cleanup by EPA/Ecology’s RCRA office.” He asserted that this showed EPA was excluding other RCRA cleanups without explanation from the site.

DSI, Northland, Long Painting, and Tytanic stated that the HRS documentation record does not account for any of these current RCRA action sites, nor why these RCRA sites have not been deferred under the RCRA Deferral Policy. DSI and Northland claimed that EPA had used this policy to defer all or part of a site previously.

Long Painting and Tytanic commented that many of the observed releases found in two upstream reaches (C and D) are sampling locations associated with these facilities, and removing these releases eliminates the need to include the reaches in the listing. They also asserted that eliminating the segments already subject to RCRA corrective action leaves non-contiguous zones which do not qualify for the NPL independently. DSI and Northland also stated that “[r]emoving the RCRA sites further supports the conclusion that the contamination in the waterway is actually non-contiguous isolated ‘hotspots.’” Long Painting, Tytanic, DSI, and Northland proclaimed that “by not following its RCRA Deferral Policy, EPA is compounding its inappropriate application of its Aggregation Policy.” Long Painting and Tytanic added this action was arbitrary and capricious and cited *Apache Powder Co. v. United States*, 968 F.2d 66, 70 (D.C. Cir. 1992).

The South Park Business Association requested that, instead of placing the site on the NPL, EPA defer to the RCRA corrective actions already underway and the work under the AOC.

In response, the decision not to defer parts of the sediment contamination in the Lower Duwamish to the RCRA program is consistent with the Superfund RCRA Deferral Policy. As stated in a Federal Register notice discussing the RCRA Deferral Policy (54 FR 41000, 41008 Oct. 4, 1989), in general, the NPL/RCRA deferral policy considers which authority is likely to most expeditiously accomplish cleanup. EPA has also stated that it will not defer sites to RCRA if RCRA corrective action may not apply to all the contamination present on the site (53 FR 23978, 23982, June 24, 1988). The U.S. Court of Appeals for the D.C. Circuit in the 1992 decision, *Apache Powder Company v. U.S.*<sup>2</sup> upheld the reasonableness of EPA's decision not to defer a site where RCRA may not apply to "all contamination present at the site" stating that, "these are policy questions appropriate for agency resolution." 968F.2d. 66, 68.

EPA has not established that all of the sediment contamination at the Duwamish site is addressable under RCRA, and commenters do not suggest that this is the case. The contaminated sediments areas adjacent to three of the four RCRA facilities (Boeing Plant 2, the Rhone Poulenc Marginal Way Facility, and the Boeing Development Center) discussed by commenters are only a portion of the much larger Lower Duwamish site. The fourth RCRA facility, the Philip Services Corporation facility, is not adjacent to the Waterway, and it has not been established that contamination migrating from it has reached the Waterway (See Attachment B to this document). EPA has declined to defer sites to RCRA in similar circumstances where a RCRA facility is contributing to widespread contamination also caused by non-RCRA facilities based on a determination that use of CERCLA would be more efficient than cleanup through coordination of RCRA and CERCLA (56 FR 5602, February 11, 1991). Under the circumstances present at this site, EPA believes that cleanup of the entire site may occur more expeditiously if the site is listed and CERCLA remedial funds are available to clean up the entire site. The listing does not preclude RCRA activities from continuing, but it does ensure that if questions arise concerning whether RCRA authority is available to address particular areas of contamination, that cleanup can proceed using CERCLA funds. Given the difficulty of tracing sediment contamination at this site back to any particular source, as discussed in section 3.1.3.13 of this support document, Identification of a Contaminated Sediment Source, EPA believes that it is prudent to list the site on the NPL and have CERCLA funds available to address all parts of the site.

### **3.1.3.7 Listing Unnecessary/AOC for RI/FS Already in Place**

DSI and Northland claimed that the listing of the Waterway to the NPL is unnecessary because four parties (the Boeing Company, Port of Seattle, City of Seattle, and King County) have already committed to completing an RI/FS both under state and federal law. DSI and Northland argued that EPA and Ecology withheld their signatures because Boeing refused to sign a new tolling agreement. DSI and Northland concluded by indicating that Ecology and EPA have publically stated that they will not sign the AOC until the site is listed on the NPL. DSI and Northland asserted that to negotiate such an agreement and then condition it on NPL listing is arbitrary and capricious.

In response, EPA acknowledges that an AOC for the RI/FS has been signed by four parties; however, the commenters' claim that EPA and Ecology refuse to sign the AOC is unfounded. In fact, EPA and Ecology both signed the AOC on December 20, 2000.

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<sup>2</sup>*Apache Powder Co. v. United States*, 968 F.2d 66 (D.C. Cir. 1992)

The presence of an AOC does not make listing inappropriate. The HRS score for the site justifies placing the site on the NPL. Further, the current AOC only addresses work to be performed through the RI/FS. It does not address implementation of remedial cleanup actions.

### **3.1.3.8 Natural Resource Damages Claims**

Mr. Glen St. Amant, commenting for the Muckleshoot Indian Tribe, submitted a copy of comments submitted previously pertaining to the AOC and the proposed Statement of Work (SOW) for the RI/FS. While specific comments on these documents are not germane to the listing of the Lower Duwamish site, the cover letter for those comments expressed the Tribe's concerns regarding NRD claims. Mr. St. Amant commented that the "Natural Resource Trustees have not been afforded adequate statute of limitations protection under the proposed alternative. [The "proposed alternative" is the work specified in the AOC and SOW.] These protections are clearly provided when a site is Superfund listed." Mr. St. Amant also noted that "the requirement to coordinate with Natural Resource Trustees exists under a Superfund listing scenario, but remains unaddressed under the proposed alternative."

South Park Business Association, Long Painting and Tytanic argued that "the real reason EPA is acting to place the Waterway on the NPL is because Natural Resource Trustees, including other federal agencies, desperately need the listing in order to revive long-expired and never-asserted claims for natural resource damages." Long Painting and Tytanic asserted that reviving NRD claims is not one of the three mechanisms to list sites on the NPL. Long Painting and Tytanic asserted that EPA's listing proposal is incomplete because it does not explain that the motivation for listing was to revive NRD claims and noted that EPA did not mention the NRD claims within the HRS documentation record or its 31 references.

DSI and Northland stated that the listing of the Waterway also raises novel legal and policy issues, namely should the listing of an NPL site be done solely to revive NRD claims. Long Painting, Tytanic, DSI, and Northland asserted that neither CERCLA nor EPA's HRS regulation authorize listing on that basis. DSI and Northland stated that, for NRD claims that have not already expired, the amendments in SARA to CERCLA Section 113(g)(1) impose a different statute of limitations for sites listed on the NPL (i.e., three years from the completion of the remedial action rather than three years from the later of the date of discovery of the loss or the date on which NRD assessment regulations are promulgated). DSI and Northland argued that the NRD claims for this site expired over a decade ago and the Natural Resource Trustees (Trustees) discovered the loss as early as the mid-1980s, if not years earlier. DSI and Northland noted that an action seeking recovery of natural resource damages for injuries and loss occurring in the Duwamish Waterway was filed by the Trustees against the City of Seattle and King County in March 1990. DSI and Northland asserted that it is improper for EPA to consider listing a site for the sole purpose of attempting to resurrect long-expired NRD claims.

DSI and Northland also argued that "[i]t appears that the only real reason for listing this site to the NPL is to revive NRD claims, which expired over a decade ago. There is no other justification for not allowing work at these sites to proceed under the state statute." DSI and Northland stated that an EPA fact sheet published in July 2000, indicated that "[i]n order for EPA not to propose the Lower Duwamish Waterway Site to the Superfund list at this time, it is critical that the Trustees obtain appropriate agreements. These agreements must extend the time frame that would be available if the site were a Superfund site . . . Boeing currently has an agreement with the Trustees. However, the trustees have informed Ecology and EPA that this agreement is insufficient to protect their claims." DSI and Northland concluded by arguing that reviving long-expired NRD claims is not a criterion for listing a site on the NPL. Moreover, DSI and Northland stated "Congress,



when it enacted SARA in 1986, did not intend for the listing of federal Superfund sites to resurrect expired NRD claims, and there is a justiciable issue regarding the statutory interpretation of CERCLA Section 113(g)(1) and its use by EPA at this site.”

In response, listing the Lower Duwamish site on the NPL is consistent with CERCLA and the HRS. EPA properly applied the HRS to determine whether the site should be listed on the NPL. The site scored above 28.50 and, thus, it is appropriate to add the site to the NPL. The site was listed on the NPL because, as the HRS score reflects, it poses a high relative risk.

Commenters cite statements in various documents to support their claim that EPA listed the site for the sole purpose of reviving natural resource damage claims. Even if those documents can be read to suggest that some part of the motivation for deciding to evaluate the site under the HRS was related to natural resource damage issues, neither CERCLA nor the HRS prohibit EPA from taking into account environmental policy considerations in determining whether to initiate an evaluation of a site under the HRS. EPA often takes policy considerations into account in determining whether to evaluate a site for listing. Doing so does not raise novel policy or legal issues. In fact, the deferral policies that commenters suggest that EPA should apply to this site are an example of one way in which EPA takes environmental policy issues into consideration in determining whether to evaluate a site. Under its deferral policies, EPA often decides not to evaluate for listing sites that would qualify under the HRS rule. Similarly, even if EPA’s decision to evaluate this site for listing was based in part on a policy decision that it would be advantageous to do so given the advantage such listing will provide to natural resource trustees in any action for natural resource damages, such a decision is not inappropriate.

As EPA explained in Federal Register notices discussing the RCRA deferral policy, consideration of such policy issues is appropriate under section 105(a)(8)(A) of CERCLA. That section directs EPA to consider certain enumerated and “other appropriate factors” in listing sites on the NPL. See, 54 F.R. 41000, 41004 (Oct. 4, 1989). Thus, EPA has the discretion to take environmental policy considerations (such as the advantage that a listing would provide to another federal Agency in its efforts to recover natural resource damages) into account in deciding whether to evaluate or list sites under the HRS.

DSI and Northland’s claim that CERCLA Section 113(g)(1) cannot be read to allow listing to revive expired NRD claims is not relevant to this rulemaking. EPA’s listing of the site does not rely on any reading of the statute of limitations provisions in CERCLA. DSI and Northland’s arguments concerning the statute of limitations for natural resources damage claim actions under Section 107 of CERCLA can be raised in the event that any such action is brought by the natural resource trustees.

### **3.1.3.9 Treaty Trust Obligations**

Mr. St. Amant, on behalf of the Muckleshoot Indian Tribe, expressed the Tribe’s “consistent position in support of listing the Lower Duwamish Waterway site on EPA’s National Priorities List.” Mr. St. Amant commented that “under a Superfund listing scenario, the EPA has a clear Treaty Trust obligation to federally-recognized Indian Tribes.” He noted that, while the AOC and SOW for the remedial investigation/feasibility study delineated Agency interaction with potentially responsible parties (PRPs), these documents were “silent on . . . [the Agency’s] relationship to the Tribe.” Mr. St. Amant commented that “the Tribe expects full involvement in the process – both in its capacity as a federally-recognized tribe and as a Natural Resource Trustee. Full involvement should include, but not be limited to, sufficient time and resources to review and comment on all draft work products and deliverables and participate in meetings related to the site.”

In response, EPA recognizes that it has a trust responsibility towards the Tribes, who have treaty protected resources that may be impacted by site cleanup decisions. As part of administering the site and overseeing the investigations and cleanups, EPA intends to provide for the direct participation of the Tribes so that the Tribal governments and their elected leaders can provide meaningful and timely input in investigation and cleanup decisions by the Agency.

### **3.1.3.10 Negative Impact on Cleanup of Other Sites**

DSI and Northland claimed that both the Wyckoff/Eagle Harbor and Pacific Sound Resources (PSR) Superfund sites are dependent on clean sand and silty sands to be dredged from the Duwamish Waterway for use as capping materials. DSI and Northland claimed that the USACE position to cease dredging in the Waterway once it is listed to the NPL will impede and delay cleanups at other contaminated sediment Superfund sites and that EPA's failure to consider this is arbitrary and capricious.

In response, listing the Lower Duwamish Waterway will not delay cleanup at the PSR or Wyckoff/Eagle Harbor Superfund sites. Sediments from the Lower Duwamish River were considered as a source of capping material for the Wyckoff/Eagle Harbor Superfund site. However, due to the amount of sediments available, grain size of the sediments, and other factors, EPA determined that the sediments from the Waterway did not match the capping needs of the project. During this construction season (August 15, 2001 - February 15, 2002), EPA will complete capping in the East Harbor (see Attachment C, June 2001 Fact Sheet for Wyckoff/Eagle Harbor Superfund site, also available from the following web-site: [http://yosemite.epa.gov/R10/CLEANUP.NSF/9f3c21896330b4898825687b007a0f33/ce32c3020f2f53f88825653a00757c1b/\\$FILE/0601wyck.pdf](http://yosemite.epa.gov/R10/CLEANUP.NSF/9f3c21896330b4898825687b007a0f33/ce32c3020f2f53f88825653a00757c1b/$FILE/0601wyck.pdf)). Upland borrow material will be used as capping material for this project. At PSR, the Duwamish Waterway is not the only source of materials used for capping. In fact, the Duwamish River is just one of several potential locations from which capping material could be obtained for the PSR Superfund site (see Attachment D, which is Table 23 from the Record of Decision (ROD)). Sediments from the Duwamish River could be used as capping material for other projects as long as the sediments met Dredged Materials Management Program and project-specific requirements.

In any event, neither CERCLA nor the HRS require that EPA consider whether listing a site on the NPL will make cleanup of another site more difficult.

### **3.1.3.11 PA Requirement**

DSI and Northland argued that EPA failed to conduct a preliminary assessment for the Waterway, as required by the NCP (40 CFR 300.420(b)). DSI and Northland stated that the NCP establishes a mandatory two-step "site assessment" process prior to scoring a site for addition to the NPL, and, therefore, conducting a PA and preparing a PA report are mandatory steps in the assessment of any site. DSI and Northland also asserted that CERCLA mandates that EPA conduct a PA upon the receipt of a citizen petition to consider listing a site on the NPL, and, according to the HRS documentation record, EPA was asked by NOAA to conduct a PA three years ago.

In response, contrary to commenters' claims, while a document titled "PA report" was not produced, a study that met all the requirements of a PA was completed for this site, and the results were documented in a report; thus, EPA met the requirements of 40 CFR 300.420(b). In this case, EPA determined that it was

appropriate to conduct a Site Inspection (SI) (in fact the SI was the equivalent of an expanded SI; see 3.1.3.13), which is a more thorough investigation of the site than that included in a preliminary assessment (see 40 CFR § 300.420(b) and (c)) and meets all the requirements of a PA (for further information see *Improving Site Assessment: Combined PA/SI Assessments* - OSWER Publication 9375.2-10FS October 1999, Attachment E of this support document or the following web-site <http://www.epa.gov/superfund/programs/siteasmt/pasifin.pdf>). As noted by Long Painting and Tytanic in their comments, EPA Region 10 responded to a NOAA petition by stating that “[a]s a first step in this evaluation process, EPA will be conducting a Site Inspection at this site.” That this was performed is recorded in CERCLIS. CERCLIS provides both a PA completion date and an SI completion date of 4/21/99. The SI report (Reference 4 of the HRS documentation record at proposal) documents that EPA satisfied all the requirements in the NCP for a PA (40 CFR § 300.420(b)), as well as those requirements for an SI (40 CFR § 300.420(c)). In recent years, EPA has attempted to improve the site assessment process by being more efficient and has combined the efforts necessary for a PA and SI together in one investigation, thereby completing two steps in one, yet still fulfilling CERCLA requirements.

### **3.1.3.12 Observed Release**

DSI, Northland, Long Painting, and Tytanic disagreed with the identification of observed releases in the waterway for several reasons. Their comments are addressed below.

#### **3.1.3.12.1 Data Quality**

DSI and Northland commented that, “of the sediment samples DR001 through DR301 that were analyzed for individual PCB Aroclors (i.e., Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260) in EPA’s Site Inspection Report, only 426 of the 2100 analytical results (or approximately 20 %) for these PCB Aroclors were **not** qualified with an ‘I’ [sic], a ‘J’ and/or a ‘U’ flag.” DSI and Northland pointed to the use of J- and U- flagged data in the determination of “Total PCBs.” DSI and Northland also noted that EPA had already acknowledged that “there are extremely limited data on PCB congeners.” DSI and Northland stated that:

EPA should explain the specific quality control criteria that were not met, the reasons why, and the potential ramifications for using qualified data or estimated values. Similarly high percentages of the other data are also qualified. EPA should explain the extent to which “I”- [sic], “U”-, and/or “J”-qualified data was used in identifying so-called “observed releases” and in scoring the Waterway, and justify the regulatory, statutory and scientific basis, if any, for doing so.

Long Painting and Tytanic commented in a footnote that “EPA has not adequately explained why its total PCB concentrations are reliable, accurate and precise when it qualifies each of them with a ‘I’ flag which ‘indicates value was assumed from other constituents by software. Result was not present in original laboratory reports.’”

In response, the use of qualified data and the rationale for using this data in establishing observed releases by chemical analysis are explained both in the HRS documentation record at proposal and in the cited references. The qualifiers are explained in the HRS documentation record on pages 10 and 11 at proposal and in the references cited for these statements of fact. EPA correctly used qualified data in accordance

with EPA's fact sheet *Using Qualified Data to Document an Observed Release and Observed Contamination*, OSWER Publication 9285.7-14FS November 1996 ("Qualified Data Fact Sheet").

The HRS documentation record (pages 10 and 11 at proposal) states:

[t]he following data qualifiers apply to . . . [the observed release] tables (Ref. 4, p. 379<sup>3</sup>; Ref. 23<sup>4</sup>; Ref. 24<sup>5</sup>):

- AC - Adjusted concentration as per EPA Guidance Document "Using Qualified Data to Document an Observed Release and Observed Contamination" (Ref. 23).
- H - EPA data qualifier indicating a high bias (Ref. 4, p. 379; Ref. 24).
- J - The analyte was positively identified and detected; however, the concentration is an estimated value because the result is less than the quantitation limit or quality control criteria were not met (Ref. 4, p. 379).
- K - EPA data qualifier indicating unknown bias (Ref. 24).
- L - EPA data qualifier indicating a low bias (Ref. 4, p. 379; Ref. 24).
- Q - EPA data qualifier indicating that the result is estimated because the concentration is below the Contract Required Quantitation Limit (CRQLs) (Ref. 4, p. 379).
- T - When present in data qualifier, indicates value was assumed from other constituents by software. Result was not present in original laboratory reports (Ref. 4, p. 379; Ref. 22<sup>6</sup>; Ref. 24).
- U - The analyte was not detected at the given concentration limit (Ref. 4, p. 379).

The references cited further explain the meaning of qualifiers and justify use of qualified data. For example, Reference 23, the "Qualified Data Fact Sheet" provides the rationale and guidelines for using qualified data. The specific reasons why the data were qualified is contained in Reference 6, *Site Inspection (November and December 1998)*, which contains the Quality Assurance Memoranda and Laboratory Data Sheets. The following flags are data qualifiers that reflect the accuracy of quantification: "H", "J", "K", "L", and "Q".

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<sup>3</sup>Reference 4, *Site Inspection Report* (April 1999)

<sup>4</sup>Reference 23, *Using Qualified Data to Document an Observed Release and Observed Contamination*

<sup>5</sup>Reference 24, *Memorandum to Linda Foster, Ecology and Environment, Inc., regarding the assignment of biases to qualified data*

<sup>6</sup>Reference 22, *Data Delivery Notes from the data set containing Duwamish SI analytical results as captured in April 1999*

As explained below, these qualifiers indicate that the reported concentration of the substance may not be the actual value, but that the value presented is within quality control limits set by the Agency. The “U” qualifier is a flag that denotes the contaminant was not detected and, thus, must be present, if at all, below the detection limit. The “T” and “AC” qualifiers are “flags” that indicate that the represented value is not present on the analytical data sheets but was calculated from information present on the analytical data sheets by the Agency.

The data validation process (which sometimes results in the addition of a qualifier to a data point) supplements the understandability of analytical data quality issues, and ensures that the Agency makes reasonable decisions based on sound information. As discussed in the HRS documentation record references, that data are qualified is often an indication that the sample was difficult to analyze, not that there is low confidence in the analysis. This is often the case with “J” and “U” qualified data (see “Qualified Data Fact Sheet.”)

HRS References 4, 6, 22, 23 and 24, explain the rationale for using qualified data for establishing observed releases.

For example, the “Qualified Data Fact Sheet” on page 6 defines the “U” qualifier as indicating: “[t]he substance or analyte was analyzed for, but no quantifiable concentration was found at or above the CRQL [contract required quantitation limit].” As explained on page 4 of the “Qualified Data Fact Sheet,” there is confidence that the true concentration is at or below the quantitation limit, therefore, making U-qualified data acceptable to establish background levels at the quantitation limit. Consistent with this, EPA used U-qualified data only to establish background levels as at least as low as the quantitation limit.

In addition, the “Qualified Data Fact Sheet” (page 6) defines the “J” qualifier as indicating: “[t]he analyte was positively identified - the associated numerical value is the approximate concentration of the analyte in the sample.” J-qualified data do not indicate that data are of low confidence or quality.

An example of how the Agency considered the “J” qualified data is illustrated in the use of the background sample DR-281 (EPA sample number 98354051); the concentration for nickel is 18.2 “JL” (23.48 AC). The “J” indicates that nickel was positively identified and detected; however, the concentration is an estimated value because the result is less than the quantitation limit, or quality control criteria were not met. The “L” indicates that after reviewing the sample results and related data, the Agency determined that, if there was any actual limitation on the quantitation accuracy, it would be that the actual concentration was possibly higher than that reported; a low bias. As cited in the HRS documentation record, the determination of low bias for this specific sample result is explained on page 2737 of Reference 6<sup>7</sup>. The 23.48 “AC” is the adjusted value which was calculated in accordance with the “Qualified Data Fact Sheet,” and the “AC” flag denotes this. Because this sample is a background sample and the bias is low, the “Qualified Data Fact Sheet” indicates to multiply a low bias concentration by an adjustment factor to inflate it to the high end of the acceptable range. The factor for nickel is 1.29, yielding the adjusted background level of nickel as 23.48.

As stated above, the “T” qualifier is not a quality control qualifier. It is a flag to the data user that the value presented is only the sum of the values of the various Aroclor mixes and that the sum is not shown on the laboratory sheets. Therefore, it does not identify any issue with the identification or the quantification of PCBs.

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<sup>7</sup> The recovery percent of nickel was 76 percent, and below the Laboratory Control Sample Analysis recovery goals of 80 to 120 percent. Thus, the bias would be low. (Reference 6, *Site Inspection* (November and December))

An example of how both J- and T-qualified data were used in the HRS evaluation is illustrated in the use of the release sample DR-131 (EPA sample number 98334038); the concentration for total PCBs in this sample is 97 "TJL." The "T" indicates that the reported concentration represents the total concentration of different Aroclors of PCB. The "J" flag, as in the previous example, indicates that PCBs were positively identified and detected; however, the concentration is an estimated value because the result is less than the quantitation limit or quality control criteria were not met. The "L" flag indicates a low bias. The direction of bias is explained on page 306 of Reference 6<sup>8</sup>. The "Qualified Data Fact Sheet" explains that for a release sample, if the bias is low, no corrective action is needed because the actual contaminant concentration may be higher than the reported value. The rationale for this is that if the reported value is sufficiently high to meet the observed release criteria, any higher value would also meet this criterion.

All qualified data used as observed release data were adjusted in accordance with the EPA fact sheet. (See "Qualified Data Fact Sheet" for further explanation of the use of qualified data.)

### **3.1.3.12.2 Background Level/Sample Similarity**

DSI and Northland questioned the similarity of the background and release samples used to establish observed releases in the Waterway. They raised issues regarding comparability of TOC (total organic carbon) and particle size, and other sampling and analysis procedures.

Regarding particle size and organic content, DSI and Northland stated that EPA had failed to explain why it did not use TOC-normalized concentrations of PCBs and PAHs in scoring the site. DSI and Northland stated:

if particle size or organic carbon content of the background and contaminated site sediments differ significantly, EPA's Office of Research and Development has indicated that it is inappropriate to directly compare contaminant residue levels without normalizing the data. EPA has recognized that the levels of metals in sediment are strongly related to total organic carbon and sediment particle size, while organic contaminants in sediments (such as PCBs and PAHs) are related primarily to total organic carbon. See Breckenridge and Crockett. "Determination of Background Concentrations of Inorganics in Soils and Sediments at Hazardous Waste Sites" EPA Publication 540/S-96/500. (December 1995)

Long Painting and Tytanic also commented that EPA had not explained why it did not normalize the observed release data based on TOC. Long Painting and Tytanic noted that the Washington State Sediment Management Standards are based on TOC-normalized criteria and that both the SI and the NOAA study contained the data to do so. Long Painting and Tytanic cited EPA publication 540/S-96/500, the Engineering Forum Issue paper also cited by DSI and Northland, as well as the 1993 RCRA AOC for the Rhone-Poulenc, Inc. Marginal Way Facility in support of this comment.

Regarding the background level, DSI, Northland, Long Painting, and Tytanic commented on the selection of the background contaminant levels for HRS purposes.

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<sup>8</sup>The recovery percent of Aroclor 1016 and Aroclor 1260 were 42 and 61 respectively, and below the Laboratory Control Sample Analysis recovery goals of 70 to 130 percent. Thus, the bias would be low.

DSI and Northland commented that “[b]y using inappropriate background concentrations, EPA has overstated the number of observed releases in the Waterway.” They asserted that EPA’s own regulations require observed releases to surface water sediments, which are based on chemical analysis, to demonstrate that a hazardous substance in the sediment sample under evaluation (i.e., the “release sample”) is “significantly above the background concentration for the site for that type of sample.” DSI and Northland asserted that the levels of contamination in most of the EPA 1999 non-background samples in the SI were extremely low and, in most instances, qualified by the laboratory. They considered the EPA background levels to be understated. DSI and Northland commented that “there is a need for further clarification of why EPA averaged all of the background sediment samples within a given grain size [i.e., particle size] classification to calculate the background concentration for each substance.” Long Painting and Tytanic submitted a similar comment.

DSI and Northland commented that at other sites proposed for the NPL, EPA typically used the highest background observed, and that EPA typically does not differentiate among grain sizes when comparing concentrations of background to potential release samples (e.g., the Fox River site). DSI and Northland considered that “[b]y evaluating observed releases based on grain size classification and average background concentrations for the Waterway,” EPA “calculated much lower background levels, which has the effect of overstating the number and degree of observed releases.” DSI and Northland asserted that if EPA had simply used the highest background, over half of the observed releases for PCBs would not have met the significance criterion. Long Painting and Tytanic echoed these comments, and added that the number of observed releases identified in the NOAA data would also be reduced if grain size were disregarded.

DSI and Northland concluded that:

[i]t appears that different background concentration rules are being applied for purposes of inflating the scoring of one site over another and for overcoming deficiencies in the scoring process. If that is the case, then EPA is no longer adhering to the purpose and intent of the HRS, which is to list only high risk sites. Instead EPA is taking what could otherwise be an accurate measure and manipulating it to serve purposes not driven by the quality of the sediments in the Waterway.

In response, the method used to establish background for each of the three data sets used to establish observed releases to the Waterway (the 1998 SI, the Boeing study, and a NOAA study) was documented in the HRS documentation record at proposal. For EPA’s SI data, EPA took a measure of central tendency of the background concentrations as the background levels, the average in each particle size range, and compared background and release levels of samples that were of comparable grain size (see pages 10-30 of the HRS documentation record at proposal.):

[b]ackground samples were selected for determining observed release concentrations by considering contamination variances expected as a function of grain size. . . . In selecting background concentrations, first all sediment samples were divided into four grain size classifications (0-25 percent, 25-50 percent, 50-75 percent, and 75 to 100 percent) based on the percent of fines present (i.e., particles smaller than sands). Then three or more relatively upriver samples were selected from each grain size classification to represent background conditions. . . . Generally, results by analyte for the selected background samples in each grain size classification were averaged for use in determining observed releases. . . .

The observed releases based on these data were then determined by comparing the average background level in each grain size classification to release samples from the same grain size categories.

For the Boeing data, background levels were established the following way: (see pages 31-35 of the HRS documentation record at proposal.)

[t]hree upstream reference (background) samples were collected (Ref. 7, pp. 45 and 134). Since grain size distributions were not provided in the final report, the highest concentration per analyte of the three background samples was used in determining the observed releases.

The highest background level available for this sampling event was used in determining observed releases.

For the NOAA data, background levels were:

selected for determining observed release concentrations by considering contaminant variances expected as a function of grain size. In selecting background concentrations, first all sediment samples were divided into four grain size classifications (0-25 percent, 25-50 percent, 50-75 percent, and 75 to 100 percent) based on the percent of total fines present (i.e., particles smaller than sands) (Ref. 18; Ref. 19), then three relatively upstream samples were selected from each grain size classification to represent background conditions. Finally, the results for the selected background samples in each grain size classification were averaged. These averages were used when determining observed releases. (see pages 35-39 of the HRS documentation record at proposal)

The average background concentrations for each grain size category were compared to downstream samples in the corresponding grain size categories.

EPA's decision to consider particle size where possible (this information was only available for the 1998 SI data set and the NOAA data set) and not TOC for both metals (inorganics) and organics in establishing background levels was reasonable. EPA examined the ranges of variation in particle size and TOC in these data sets and determined that, given the range of percent fines (i.e., a measure of particle size) in the samples and the percent TOC, it was reasonable to account for particle size but that it was unlikely that TOC would have a major effect. For the SI data, there was a range of percent fines from 0.1 percent to 100 percent, with a mean of 65.2 percent and standard deviation of 24.7, a considerable range. However, the range in percent TOC from 0.08 percent to 9.23 percent, with a mean of 2.2 percent and a standard deviation of 1.0 percent, was much narrower. It is therefore less likely that these differences in percent TOC would have a significant effect on the concentration of metals. For organics, again given the small range of percent TOC, it was considered less likely that this would have a significant impact on organic contaminant levels. However, for particle size, given that fines have considerably more surface area per volume for organics to sorb to than non-fines (see generally, *Environmental Soil Physics*, Hillel, Daniel. Academic Press. 1998. Pages 69 through 72), and wide range of percent fines in the samples, EPA considers it reasonable to also consider particle size in identifying observed releases of organics. Thus, although EPA's approach to considering TOC and particle size differed from the approaches suggested in EPA publication 540/S-96/500, the Engineering Forum Issue paper cited by commenters, the approach was justified given the specific circumstances at the Duwamish site.<sup>9</sup> The information used to perform the analyses discussed above is

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<sup>9</sup> EPA notes that although the Engineering Forum Issue paper provides a case for taking TOC and particle size into account when evaluating metals and TOC into account when evaluating organics such as PCBs, this paper



contained in the HRS documentation record at proposal or in the references cited. Attachments F and G to this support document consolidate and illustrate these analyses.

With respect to EPA's use of average rather than highest contaminant concentration in background samples to evaluate observed releases, based on comments submitted, EPA has decided that using the highest concentration of each substance (both inorganic and organic) in each particle size range used in the HRS documentation record at proposal would be a more conservative approach than using the average concentration. These revised background concentrations are highlighted in the revised HRS documentation record available in the EPA headquarters and Region 10 Superfund docket.

Using these revised background levels has little effect on the number of observed release samples. In fact, for the SI data, 91 of the 95 sample locations (96 percent) identified as representing observed release sample locations in the HRS documentation record at proposal would still be identified as observed release samples for any observed release substance. For the NOAA data, only PCB releases were identified in the HRS documentation record at proposal. Fifty-seven of the 76 sample locations (75 percent) identified originally as documenting observed release locations would still be identified as observed release sample locations using this approach. For the Boeing data set, which provided support for 74 observed releases, EPA did use high background concentration to determine observed releases. The information used to perform these analyses is contained in the HRS documentation record at proposal or in the references cited. Attachments F and G to this support document consolidate and illustrate these analyses.

Moreover, although EPA maintains that an approach that adjusts for particle size for organics and metals was reasonable at this site given the range of variation in particle sizes and of TOCs discussed above, EPA has also reexamined the relationship between grain size, TOC, and PCB concentrations in the EPA 1998 SI sampling results. For this site, because of EPA's decision to do a thorough SI, there is sufficient information in the SI to determine if particle size and TOC are correlated with PCB levels. (The information used to perform these analyses is contained in the HRS documentation record at proposal or in the references cited. Attachments F and G to this support document consolidate and illustrate these analyses.) EPA first compared the PCB concentrations in 301 surface sediment samples collected as part of the SI to the TOC levels. The correlation factor was determined to be 0.16, where a 0.00 reflects no correlation and a 1.00 reflects perfect

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was not intended to be used as guidance for performing site assessments for HRS listing. As stated on page 2 of this Issue paper:

This issue paper is narrowly focused and is for **educational purposes only** by project managers. It is not meant to be a formal guidance document or "cookbook" on determination of background concentrations of inorganics [metals] at hazardous waste sites. . . .

As also noted on page 2 of this Issue paper, the paper's focus is on issues associated with the remediation stage of site cleanup. Its intended audience is Remedial Project Managers, who are typically responsible for overseeing site cleanup and not for overseeing the evaluation of whether a site is eligible for listing. It discusses and recommends activities that are often beyond the scope of the type of investigation carried out for scoring sites under the HRS. For example, page 2 of this Issue paper discusses the need to perform "statistical analysis for determining whether contaminant levels are significantly different on a potential waste site and a background site," whereas, as discussed above, the HRS identifies observed releases using a simple three times background approach. At this particular site and for some of the data sets EPA relied on to score the site, EPA has the information to evaluate the relationship between contaminant concentrations and TOC and particle size. However, this is not always the case at other sites evaluated for listing and neither the HRS or HRS guidance suggest that it is necessary for EPA to do so.

correlation. EPA repeated the analysis for the correlation between particle size and PCB concentration. The correlation was actually slightly less, 0.13. These analyses demonstrate that, for this particular site and this data set, PCB levels are only marginally, if at all, correlated with either particle size or TOC (i.e., PCB concentrations are not significantly related directly to particle size or TOC levels).

Based on these results, the Agency re-evaluated the identification of observed releases of PCBs using the highest PCB concentration in any sample identified as background in the HRS documentation record at proposal and found that 117 observed releases of PCBs can still be identified across the three data sets.<sup>10</sup> Again, the information used to perform these analyses is contained in the HRS documentation record at proposal or in the references cited. Attachment G to this support document consolidate and illustrate the new comparisons.

Further, EPA has also performed the same analysis on the relationship between TOC and contaminant concentrations, and between particle size and contaminant concentrations for the other organic substances (besides PCBs) identified in the HRS documentation record at proposal for the SI data. Again, little correlation was found. Based on these findings, EPA re-evaluated the EPA SI data, using the highest concentration of the specific organic contaminants, including PCBs, in any SI background sample to determine observed releases and found that 56 of 95 sample locations identified as observed release sample locations in the HRS documentation record at proposal could still be identified as observed release locations. This re-evaluation demonstrates that even if EPA relies on a site specific correlation analysis, there are a substantial number of observed releases for organic contaminants alone.

Further, even if EPA followed commenters' suggestion and normalized the three data sets used to identify observed releases of PCBs for TOC content despite the site specific evaluation that demonstrates that the correlation between PCB and TOCs is not strong, there would still be 67 documented observed releases across the three data sets. Again, the information used to perform these analyses is contained in the HRS documentation record at proposal or in the references cited. Attachments F and G to this support document consolidate and illustrate the new comparisons.

EPA also notes that, while under any of the analyses discussed above the number of observed releases would be reduced, it would not change the site score. The site score is based on the square root of the sum of the squares of the pathway scores divided by 4 (see HRS Section 2.1.1, *Calculation of HRS site score*). The pathway score is based on likelihood of release multiplied by waste characteristics multiplied by targets, and

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<sup>10</sup>EPA notes that if it had been aware of this lack of correlation between particle size and PCB levels when determining samples to use as background samples, it is likely that EPA would have chosen a different set of background samples and the result would have been lower background contaminant concentrations and thus more observed releases. In conducting the SI, all samples originally collected for use as background samples had no detectable PCBs. EPA later chose to designate other samples, that were originally collected for use as release samples (such samples were collected in areas of the waterway that were contaminated, rather than in upstream locations arguably more representative of background conditions), as background samples to ensure that there were multiple samples with particle sizes in all the size ranges (all particle size ranges were not found in the upstream samples originally collected for background). Several of these "converted" background samples are intermixed with several samples identified as observed releases in the HRS documentation record at proposal (See section 3.1.3.13.4 of this support document). For example, the "converted" background sample with the highest PCB concentration, DR281, is intermixed with samples DR267, DR271 and DR276 which were identified as observed release samples in the HRS documentation record at proposal (see Map Folio of Reference 4 for a map of the sample locations). Hence, the resulting highest background level can be considered quite conservative, and not necessarily representative of what would have been highest background level if particle size was not considered a factor.

this product divided by 82,500 (see HRS Section 2.1.2, *Calculation of pathway score*). Since there would be many samples that meet the observed release criteria, no matter how evaluated, likelihood of release would remain 550 (see HRS Section 2.3, *Likelihood of release*, of the HRS). Waste characteristics is a product of the properties of the hazardous substances and the hazardous waste quantity (HWQ). PCB was the hazardous substance used to calculate the waste characteristics value, and PCBs are still present within the Waterway (see pages 50 and 56 of the HRS documentation record at proposal). The HWQ factor value is 100, and that would remain unchanged because Level II targets are present in the Waterway (see HRS Section 2.4.2.2, *Calculation of hazardous waste quantity factor value* and pages 54 and 59 of the HRS documentation record at proposal). The waste characteristics would remain 320. The targets value would remain unchanged (see pages 54-55 and 59-60 of the HRS documentation record at proposal). The human food chain threat score would be  $(550 \times 320 \times 45.030003) / 82,500$  equals 96.06 (see HRS Section 4.1.3.4 *Calculation of the human food chain threat score for a watershed*). The environmental threat score would be  $(550 \times 320 \times 225.0075) / 82,500$  equals 480.016 subject to a maximum of 60 (see HRS Section 4.1.4.4, *Calculation of environmental threat score for a watershed*). The watershed score would remain 100 (see HRS Section 4.1.5, *Calculation of overland/food migration component score for a watershed*). Therefore, the site score would remain 50.00.

In addition, as discussed in section 3.1.3.14 of this support document, the reduction in the number of observed release samples does not call into question EPA's characterization of all contaminated sediments as one site.

### **3.1.3.12.3 Other Sample Similarity Issues**

DSI and Northland raised several factors dealing with the similarity of background and release samples besides those related to TOC and particle size levels (which are discussed in section 3.1.3.12.2 of this support document). DSI and Northland stated that EPA should explain and address:

- whether comparable analytical methods were used for both on-site and background site samples (and how the differences in the NOAA and EPA methods QA/QC procedures might affect data quality);
- whether similar sample collection methods were used because different sampling devices can produce greatly different results;
- whether the depths of sampling were considered;
- how much time passed between when the background sediments were collected and when the release samples were collected (and, if data on metals were collected, whether they were collected during the same season); and
- whether contaminant levels are expressed on the same basis.

In response, the similarity of background and release samples regarding the considerations above is sufficient for HRS screening purposes. In fact, within each of three sampling data sets used in the HRS scoring, the EPA SI study, the NOAA study, and the Boeing study, the background and release samples were collected and analyzed using the same methods and procedures, and during the same sampling events. Because of the differences in the studies' timing and other factors, the results of each study were analyzed discretely in assigning the HRS factor values, although, as discussed elsewhere in the document, they are consistent in their findings.

Regarding the 1998 EPA Site Inspection, page 10 of the HRS documentation record at proposal specifically summarizes the information requested by DSI and Northland, and cites primary documents that discuss the information in greater detail (e.g., Reference 4 of the HRS documentation record at proposal, the SI report). The HRS documentation record states:

- “Surface sediment samples were analyzed for a variety of analytical suites in varying combinations dependent on the suspected contaminants at each individual location. All samples were analyzed for target analyte list metals (EPA Method series 6000/7000), Base/ Neutral/Acid extractable organic compounds (EPA Method 8270), PCBs (EPA Method 8082), total organic carbon (TOC) (EPA Method 9060), and grain size (ASTM D-442-63) (Ref. 4, p. 14; Ref. 5, pp. 56-59). Selected samples also were analyzed for pesticides (EPA Method 8081), organotins (Puget Sound Estuary Program protocols), and dioxin/furans (Ref. 4, p. 14; Ref. 5, pp. 56-59).”
- “All surface water samples were collected from 5 to 15 centimeters with a decontaminated stainless-steel van Veen grab sampler (Ref. 4, pp. 13 and 15; Ref. 5, pp. 24 and 25). Up to 11 grabs were required at each station to retrieve sufficient sediment volume for the required analytical suite (Ref. 4, p. 13). Samples were homogenized in stainless steel containers and then placed in pre-cleaned sample jars (Ref. 4, p. 13). All sample containers were stored on ice in coolers maintained under chain-of-custody prior to and during shipment (Ref. 4, pp. 13 and 15; Ref. 5, p. 23; Ref. 15).”
- “Consultants for EPA conducted Lower Duwamish SI Field Work in August and September 1988 (Ref. 4, pp. 42 through 364).” The exact date that each background and release sample was collected is contained in Reference 4 of the HRS documentation record at proposal on the cited pages containing the “Surface Sediment Field Sample Record” for each sample. These records are cross-indexed by the EPA sample numbers which are shown in Tables 1 through 5 of the HRS documentation record at proposal (pages 12 through 30). All samples for all contaminants, including metals, were collected during the same season.
- The analysis units for all results are shown in Tables 1 through 5 of the HRS documentation record at proposal (pages 12-30). The same units for groups of similar substances (inorganics, PCBs, organotin, BNAs [Base/Neutral/Acid extractable organics]) were used for both the release and background samples. All individual contaminant levels are expressed on the same basis, and, more importantly, all comparisons used in the HRS scoring were performed using the same basis.

Regarding the 1997 Boeing Company Phase I Site Characterization study, page 31 of the HRS documentation record at proposal specifically summarizes the information requested by DSI and Northland, and cites primary documents that discuss the information in greater detail (e.g., Reference 7 of the HRS documentation record at proposal, the Boeing report for the study). The HRS documentation record states:

- “Samples were analyzed for PCBs, Aroclors and hexachlorobenzene (SW-846 Method), SVOCs [semi-volatile organic compounds] (SW-846 Method 8270B), the metals arsenic, cadmium, chromium, copper, lead, nickel, silver, zinc (EPA Method 200.8), mercury (SW-846 Method 7471), TOC (Plumb and PSEP), total solids (EPA Method 160.3M), and grain size distribution (Method number not provided) (Ref. 7, pp. 19, 24, and 136).”
- “Samples were collected with decontaminated stainless steel equipment (i.e., van Veen grab sampler, Ponar grab sampler, or spoons) and were homogenized in stainless steel bowls (Ref. 7, p. 26). Immediately after sample containers were filled, they were placed on ice at 4° C (Ref. 7, p. 27).

Samples were retained at this temperature from the time that they were collected until they were hand delivered to the laboratory (Ref. 7, p. 27). Chain-of-custody forms were delivered with the samples to the laboratory (Ref. 7, pp. 27 and 134)."

- "Following laboratory analysis, sample results underwent a quality assurance review (Ref: 7, pp. 128 through 147). Based on this review, a majority of the data quality issues that were identified did not affect the major chemicals of concern (Ref. 7, p. 132). All quality control criteria used to evaluate the analytes used . . . were considered acceptable (Ref. 7, p. 133)."
- "A total of 88 3-part composite surface (0 to 10 centimeters) sediment samples were collected at stations adjacent to Boeing facilities and in Slips 4 and 6 (Ref. 7, pp. 10, 21, 23, 43, 44, 45)."
- "The Boeing Company (Boeing) performed a Phase I Surface Sampling Screening in October 1997 (Ref. 7, p. 9)." Page 12 of Reference 7 states the "Surface sediment samples were collected from October 8-19, 1997 . . ." All samples for all contaminants, including metals, were collected during the same season.
- The analysis units for all results are shown in Table 6 of the HRS documentation record at proposal (pages 31 through 35). The same units for all individual contaminants were used for both the release and background samples. All individual contaminant levels are expressed on the same basis, and, more importantly, all comparisons used in the HRS scoring were performed using the same basis.

Regarding the 1997 NOAA Duwamish Waterway Sediment Characterization study, page 35 of the HRS documentation record at proposal specifically summarizes the information requested by DSI and Northland, and cites primary documents that discuss the information in greater detail (e.g., Reference 8 of the HRS documentation record at proposal, the NOAA study report). The HRS documentation record states:

- "Sediment samples were analyzed for PCBs, PCTs [polychlorinated terphenyl] (both using a modification of NWFSC-ECD procedures), TOC (using Puget Sound Protocols for Measuring Conventional Sediment Variables), and grain size (following the procedures in Sweet et al.) (Ref. 8, p. 15; Ref. 27, p. 89 and 90)."
- "All samples were collected in accordance with the Sampling and Analysis Plan for the Duwamish River Sediment Study (Ref. 8, p. 14; Ref. 27, pp. 2 through 84). All sediment samples were collected with dedicated or decontaminated stainless steel sampling equipment and were placed into precleaned containers (Ref. 27, pp. 15, 16, and 23). Sample containers were stored in coolers with ice and were shipped under chain-of-custody to analytical laboratories (Ref. 8, pp. 86 and 88; Ref. 16; Ref. 27, pp. 18 and 22)."
- "All sediment samples were collected from the upper 10 centimeters of material retained for analyses (Ref. 27, p. 15)."
- "Field operations were conducted from September to November 1997 (Ref. 8, p. 14; Ref. 30)." All samples for all contaminants, including metals, were collected during the same season.
- The analysis units for all results are shown in Tables 7 through 10 of the HRS documentation record at proposal (pages 36 through 39). The same units for all individual contaminants were used for both the release and background samples. All individual contaminant levels are expressed on the same

basis, and, more importantly, all comparisons used in the HRS scoring were performed using the same basis.

### **3.1.3.12.4 Background Location**

DSI and Northland stated that EPA should explain and address “whether the background site was representative of the chemical contamination levels immediately up-current of the Waterway sediments.

In response, the background sample locations were chosen to reflect the conditions up-current of the site. If anything, the contaminant levels found in these background samples are very conservative estimates of the contamination levels outside the influence of the site. (See discussion below of how background samples were chosen for EPA SI data set.) The location of the background samples were chosen so as to be upstream of the area being investigated, but sufficiently close to the Waterway study area so as to be reflective of environmental conditions as possible.

As discussed above in section 3.1.3.12.2 of this support document, background for HRS purposes need not reflect “natural conditions,” but does need to establish that there has been a significant increase in contaminant levels due to releases from the site. It can contain some contamination from the site as long as other site samples contain contamination at levels significantly above that in the background sample, and the increase is due, at least in part, to the site. Section 2.3 *Likelihood of release*, of the HRS states: “[t]he minimum standard to establish an observed release by chemical analysis is analytical evidence of a hazardous substance in the media significantly above the background level.” The *Hazard Ranking System Guidance Manual* (p. 67) defines background level as:

[t]he concentration of a hazardous substance that provides a defensible reference point that can be used to evaluate whether or not a release from the site has occurred. The background level should reflect the concentration of the hazardous substance in the medium of concern for the environmental setting on or near a site. Background level does not necessarily represent pre-release conditions, nor conditions in the absence of influence from source(s) at a site...

The *Hazard Ranking System Guidance Manual* (p. 76) also suggests that for tidal areas:

In tidal water bodies, background samples ideally should be collected beyond the farthest upstream point at which substances from the site may be transported by the tide. If it is difficult to determine exactly how far upstream substances might be transported, it may be appropriate to collect background samples above the “head of the tide,” (i.e., the most upstream point at which tidal cycles are present), as long as it isn’t too far upstream to be unrepresentative of background. In some cases, a series of samples successively farther upstream may be required.

As discussed on page 10 of the HRS documentation record at proposal, for the 1998 SI, five samples were specifically collected in an upstream area. However, these samples were found to be not reflective of the range of particle sizes. Therefore, EPA supplemented these samples by selecting three or more relatively up-river (such samples were in the upriver portion of the contaminated study area, but were downstream of the five samples originally collected as background samples) samples from each grain size classification to represent background conditions. For the Boeing data set, as discussed on page 31 of the HRS

documentation record at proposal, Boeing selected three samples collected upstream of their study area. (See Reference 7 of the HRS documentation record at proposal, pages 45 and 134.) For the NOAA study, again, three relatively upstream samples for each particle size range were selected (page 35 of the HRS documentation record at proposal).

Therefore for each data set used in establishing observed releases at this site, upstream samples were used to establish background levels, consistent with guidance. As such, for HRS purposes, they are sufficiently representative of upstream conditions to identify observed releases at this site.

### **3.1.3.12.5 Use of Sediment Samples**

DSI and Northland asserted that the organotin (e.g., tributyltin) concentrations should have been related to pore-water concentrations, not bulk sediment concentrations, as was done at the Harbor Island Superfund site [a nearby site]. DSI and Northland also pointed out that an interagency work group was formed by EPA in 1996 to identify and evaluate various approaches to deriving a sediment effects-based cleanup concentration for use in Puget Sound. The group recommended interstitial water concentrations should be measured for organotin.

In response, while for remediation purposes, interstitial concentrations of organotins may be recommended in some site-specific situations to develop cleanup concentrations, this level of site-specific information is beyond the required scope of the HRS, a screening tool. HRS Section 4.1.2.1.1, *Observed Release*, specifically states, when identifying observed releases to surface water by chemical analysis that surface water, benthic organisms, or sediment samples be used. As discussed in the HRS documentation record at proposal, the observed releases of tri-butyltin were based on results for the 1998 EPA SI study and sediment samples were used (see pages 10 through 35 of the HRS documentation record as proposed). Therefore, the observed releases of organotins were appropriately identified for HRS purposes based on sediment samples.

EPA notes however, that while not used in the HRS scoring, 15 pore-water samples were collected and analyzed as part of the 1998 EPA SI (Reference 4 to the HRS documentation record at proposal). Page 23 of this report states that tributyltin was found in 53 percent of the samples analyzed, and the concentrations ranged from non-detect to 0.08 micrograms per liter. This data could be used to establish an observed release for HRS purposes.

### **3.1.3.12.6 Releases Below Regulatory Limits**

DSI and Northland commented that “the NOAA PCB study [Reference 8 of the HRS documentation record at proposal, discussed in the HRS documentation record and used to support observed releases] concluded that only about 20% of the Waterway being proposed for listing exceeds the SQS” [the State of Washington Sediment Management Standards’ Sediment Quality Standards]. DSI and Northland stated that, “[a]ccording to the Corps, the sediment quality from the turning basin North to the 16<sup>th</sup> Avenue Bridge is at or below SQS,” and that “most sediments within the navigation channel north of the 16<sup>th</sup> Avenue Bridge to the First Avenue Bridge are generally below Contaminant Screening Levels under state sediment management standards.”

In response, that some of the observed release samples are below the “SQS” is not relevant to HRS scoring. On July 16, 1982, when responding to public comments on the proposed (original) HRS (47 FR 31188), and

again on September 8, 1983 (48 FR 40665), the Agency rejected the idea that releases within regulatory limits should not be considered “observed releases” under the HRS. As the Agency noted in 1982,

emission or effluent limits do not necessarily represent levels which cause no harm to public health or the environment. These limitations are frequently established on the basis of economic impacts or achievability.

By contrast, an observed release represents a 100 percent likelihood that substances can migrate from the site (47 FR 31188, July 16, 1982).

Section 2.3 of the HRS, *Likelihood of release*, (55 FR 51589, December 14, 1990) states that an observed release can be established either by direct observation or by chemical analysis. An observed release by chemical analysis has occurred when a contaminant is measured significantly above background level if some portion of the release is attributable to the site. Even though levels may be lower than regulatory limits, an observed release has nevertheless occurred if the measured levels are significantly higher than background levels. The HRS does, however, consider whether releases are above regulatory limits in evaluating target populations, increasing by a factor of 10 the weight assigned populations exposed to contaminants above the limits (e.g., see HRS Section 4.1.3.3.2.1, *Level I concentrations*).

Of course, the observed release factor alone is not intended to reflect the hazard presented by the particular release. Instead, the hazard of the site is approximated by the total HRS score, which incorporates the observed release factors with other factors such as waste characteristics (including waste quantity, toxicity, and persistence) and targets. This total HRS score reflects the hazard of the site relative only to the other sites that have been scored.

### **3.1.3.12.7 Biological Testing**

DSI and Northland pointed out that EPA’s Site Inspection only conducted bulk sediment chemical testing and did not include confirmatory biological testing. DSI and Northland asserted that “[a]reas that exceed the state Sediment Management Standards’ Sediment Quality Standards (‘SQS’) value should undergo biological testing prior to listing,” and that this “[t]esting would assess the significance of any SQS chemical exceedances and, very likely, demonstrate that large areas of the Waterway would not exceed the HRS threshold if individually scored.”

In response, biological testing, the collection and analysis of tissue samples to document contamination is present in the biota, is not required to identify observed releases or to show that the contamination poses a threat to aquatic human food chain organisms or to environmental receptors when scoring a site using the HRS. The reliance on biological testing was considered when the present HRS was proposed (53 FR 51589, December 23, 1988) and when it was promulgated (55 FR 51557, December 14, 1990). In both cases, it was not included as a requirement to evaluate the Human food chain threat of the surface water pathway. Commenters on the proposed HRS (53 FR 51589, December 23, 1988) suggested that the food chain threat should only be evaluated when there was evidence that hazardous substances were actually being consumed. The Agency responded, in part:

Data requirements to identify such a threat would include the collection and analysis of tissue samples from the target fisheries. The Agency feels such data requirements needed to evaluate such evidence of hazardous substance consumption at every site would be too



excessive and time consuming at the site screening (i.e., HRS) level of accuracy. Limiting consideration of human food chain impacts only to those situations where there is clear and documented evidence that hazardous substances are being consumed would likely underestimate risks at a number of sites . . . (*Response to comments on the Revisions to the Hazard Ranking System*, OERR, November 1990)

The Agency considers the selective biological sampling in areas where SQS are exceeded, as suggested by the commenters, to be more appropriately conducted as part of the risk assessment component of the remedial investigation that typically follows listing.

Instead, the HRS permits use of biological testing information if available. For example, for the *Human Food Chain* threat, HRS Section 4.1.3.1 directs observed release to be assigned the same as for the surface water drinking water threat. Section 4.1.2.1, *Drinking water threat*, governs observed release for the surface water drinking water threat and states that observed releases by chemical analysis to surface water can be established using water, sediment, or benthic sessile organisms. In HRS Section 4.1.3.3, *Human food chain threat-targets*, the HRS identifies three alternative ways to establish actual contamination of a fishery: (1) the presence of a substance in an observed release to a fishery with a bioaccumulation factor of 500 or greater, (2) the presence of a fishery closed because of contamination from the site, or (3) an observed release based on sessile benthic human food chain organism samples (biological testing). In addition, the HRS allows for increased weighting (level I contaminated targets), if the concentration found in a non-sessile benthic human food chain organism taken from the area of an actually contaminated fishery is above FDA ingestion levels (biological testing).

Similarly, no biological sampling is required to evaluate aquatic environmental targets to be considered actually contaminated. Section 4.1.4.3 of the HRS directs the user to consider these targets actually contaminated if there is a point of direct observation within the sensitive environment or if they are in the zone of actual contamination (between the probable point of entry (PPE) and the furthest downstream sample that meets observed release criteria.)

As discussed on pages 53 and 54 of the HRS documentation record at proposal, the Duwamish River fishery in the Waterway is evaluated as actually contaminated based on the presence of substances with observed releases with a bioconcentration factor value (BCF) of 500 or greater. Also, as explained on pages 58 through 60 of the HRS documentation record at proposal, several environmental targets were evaluated as either actually contaminated (level II) or potentially contaminated based on the location of the farthest downstream observed release sample. No actual biological testing was used, nor was any required.

### **3.1.3.12.8 Natural Attenuation and Source Control**

DSI and Northland asserted that “EPA should evaluate and document how sediment chemical concentrations have improved since the late 1980s due to on-going source control efforts.” DSI and Northland referred to scientific research attached to its comment in combination with the Site Inspection Report to support this. DSI and Northland asserted that this evaluation will likely identify areas that not only exhibit significant improvement due to natural attenuation and source control efforts, but also that would not exceed the HRS threshold if individually scored.

In response, the HRS does not require consideration of historical trends in contaminant levels when evaluating a site. The most recent studies used in the HRS evaluation, the 1998 EPA SI, shows considerable contamination present in the Waterway. This is sufficient for HRS purposes to score the site.

Furthermore, a study to determine whether contaminant levels are decreasing would require the same sampling and analysis methods, and the same sampling locations over a long period of time and sufficient samples to be taken each time to rule out the possibility that the changes observed were not just due to random or site-specific variation. As the commenters have pointed out elsewhere in their comments, while there have been several studies performed over the last few years, the methods, and the sampling locations have been different. Insufficient analysis of these studies have been performed to determine if, given the amount of variation in site conditions and analytical results of these studies, a statistically significant trend downward is occurring or if only variation due to study design differences is being noted.

If the commenter is suggesting that a remedy might be to allow the contamination to attenuate naturally, this is a remedial decision, not a listing criteria, and is considered in the remedy selection stage of the Superfund process.

### **3.1.3.13 Identification of a Contaminated Sediment Source**

DSI, Northland, Long Painting, and Tytanic argued that EPA failed to follow its own regulations and guidance when listing this site. More specifically, DSI, Northland, Long Painting, and Tytanic asserted that EPA guidance requires that before scoring an area of surface water sediment contamination, where the original source of the contamination is unidentified, efforts should be undertaken to identify the original source(s) of contamination. These efforts should be equivalent to those of an expanded site inspection (ESI). A source should generally not be designated as “unidentified” until sampling has been undertaken in an area and a search for the original source(s) has been conducted (within the scope of an ESI). DSI and Northland claimed that EPA only conducted a focused SI and failed to conduct an ESI, contrary to its guidance.

DSI and Northland asserted that the “riverfront, . . . together with the abutting area, is home to thousands of properties owned and occupied by individuals, businesses, and government entities,” and that “[t]hese properties may or may not be contaminated and may or may not have contributed to impacts in the Waterway.”

Long Painting and Tytanic’s assertions on this issue are similar to DSI and Northland’s. Long Painting and Tytanic asserted that:

- “EPA has failed to identify or evaluate the original sources of the so-called sediment contamination,”
- the HRS documentation record make no attempt to distinguish between degrees of contamination and risk or to identify significant portions of the Waterway which already meet the State of Washington’s Sediment Management Standards,
- “[i]nstead of taking the time to do an adequate analysis of the various land-based sources of contamination identified in the numerous reference documents that are included in the record, or should have been included in the record, and target those portions of the Waterway which demonstrate levels of contamination that might warrant individual scoring under the HRS, EPA arbitrarily takes a shortcut approach and simply declares that the only ‘source’ to be evaluated consists of the ‘contaminated sediments in the Duwamish River watershed.’”

Long Painting and Tytanic also asserted that the “agency has violated its own HRS regulations and guidance and has acted inconsistently with the scoring approach it has used at other sites involving contaminated sediments in waterways.” Long Painting and Tytanic argued that at other waterway sites EPA has performed a much more careful review of the original sources and locations of contaminated sediments, and identified the Alcoa (Point Comfort)/Lavaca Bay site as an example of where EPA did not identify the sediment as a source.

Long Painting and Tytanic pointed out that the HRS definition of source says not to include surface water sediments as a source, except in the case of contaminated sediments with no identified source. Long Painting and Tytanic pointed out EPA’s Guidance Manual states that before scoring a sediment source, efforts should be made to identify the original source(s) of contamination, and that these efforts should be equivalent to those of an expanded SI. Long Painting and Tytanic stated that the Guidance states that this should include:

- Research on site history and regulatory status;
- Site reconnaissance;
- Consideration of hazardous substances affiliated with industries of potential concern at the site;
- Records search and interviews with employees; and
- Sampling to eliminate or confirm other possible sources.

Long Painting and Tytanic stated that “EPA has made no attempt to take any of these steps to identify the original sources. Instead, it simply states that ‘a single source of hazardous substances for the contaminated substances has not been identified.’” Long Painting and Tytanic continued,

[h]ad EPA merely looked closer at the various reference documents that are appended to the DR and inquired of its RCRA staff and the Washington Department of Ecology, it would have discovered numerous investigations and studies that had been performed to identify various original sources of the sediment contamination that is immediately adjacent to current or former industrial facilities and/or is found at the discharge end of outfall pipes used by King County and City of Seattle for combined sewer overflows and stormwater discharges.

Long Painting and Tytanic accused EPA of taking this approach for two reasons. First, Long Painting and Tytanic claimed that “taking this required approach would not have allowed the agency to declare the entire Lower Duwamish Waterway as the ‘source,’ thereby limiting the natural resource damage claims by the Trustees to the isolated pockets of contamination that are associated with identified sources and that would individually score above the HRS threshold.” Second, Long Painting and Tytanic claimed that “[i]n basing its HRS scoring on the entire Waterway as a single source of contaminated sediments, EPA also seeks to avoid confrontation with its longstanding ‘Aggregation Policy.’”

In response, the identification of contaminated sediments in the Lower Duwamish Waterway as a contaminated sediment source is consistent with the HRS, and with EPA’s guidance. The SI performed at this site is the equivalent of an expanded SI. As discussed below, the results of the SI verified that any particular portion of the sediment contamination in the waterway could not be attributed to any particular source within the scope of the type of investigation appropriate at the HRS listing stage.

As noted by Long Painting, Tytanic, DSI, and Northland, EPA explained the scope of both a Focused SI and an Expanded SI in its *Guidance for Performing Site Inspections Under CERCLA* (EPA/540-R-92-021, September 1992.). It also describes a third type of SI, a “single SI,” which is what was performed for this

site. The comparison of the three SIs is found in Table 4-7, *Observed Release Sampling Strategies* (page 57) of this guidance, reproduced below. This table shows the SI study performed by EPA at the site was the equivalent of an ESI or a single SI.

**TABLE 4-7: OBSERVED RELEASE SAMPLING STRATEGIES**

CRITERION	FOCUSED SI	EXPANDED SI AND SINGLE SI
Objective	To test hypothesis (suspected release)	To demonstrate a release based on HRS documentation requirements
Date quality	Less rigorous (e.g., DUC-II) to rigorous (e.g., DUC-I)	Rigorous (e.g., DUC-I)
Background samples	Limited, 1 background to 3 release samples  May rely on published regional data	2 background to 3 release samples  Generally should not rely on published data to establish background levels
Attribution samples	Limited to what is necessary to test hypothesis (suspected release)	Those necessary to attribute a portion of a release to the site being evaluated
QA/QC samples	Limited to what is necessary to test hypothesis (suspected release)	Those necessary to obtain precise and accurate data within the scope of the SI

**Source:** *Guidance for Performing Inspections Under CERCLA*

The guidance make it clear that a focused SI does not necessarily obtain sufficient information to determine an HRS score for a site, particularly for complex sites. For example, page 9 of this guidance also explains that a focused SI is aimed at testing the PA hypothesis that further action is needed. Specifically regarding attribution, page 10 of the guidance states that “[t]he number of focused SI samples is typically less than the number of samples required to detect all hazardous substances, and to definitively attribute them to the site. More background, quality assurance and quality control (QA/QC) samples may be needed to support HRS attribution requirements.” The guidance also explains that the product of a focused SI may be a decision to perform an expanded SI.

In contrast, as explained on page 11 of this guidance, the objective of an expanded SI is to collect all data necessary to prepare an HRS scoring package to propose the site to the NPL, including collecting samples to attribute hazardous substances to site operations and to establish representative background levels.

A single SI, as described on page 12 of the guidance, is performed when “the quality of available data and site characteristics strongly indicate a significant threat,” and/or “whether all data necessary to document an HRS score can be collected efficiently at one time.” A single SI is a combination of a focused and an expanded SI.

Based on these statements, it is clear that the SI for this site is equivalent to an ESI. The intent of the SI was to obtain sufficient information to obtain an HRS score. The SI carried out for the site included collection of 312 surface sediment samples, 35 subsurface sediment samples, and 16 sediment pore water samples and

performed an analysis for all common contaminants (see pages 12 and 13 of reference 4 of the HRS documentation record at proposal). This is beyond the scope of what guidance suggests for a focused SI. To simply verify the PA hypothesis that an observed release had occurred, this many samples would not have been needed. The extensive sampling carried out was consistent with EPA guidance that EPA should carry out an expanded SI in an attempt to identify sources before designating sediment contamination as a source. However, even with this sampling effort, EPA was not able to attribute contamination to any particular source.

The definition of source in the HRS provides that contaminated sediment should only be identified as a source if there is no “identified source.” Generally, EPA interprets the term “identified source” to be a source to which a release can be at least partially attributed. This interpretation follows from the requirement in the HRS that observed releases be at least partially attributable to a site when sources at a site are identified. If an observed release can be attributed to a source, the source should be considered an “identified source.” On the other hand, if observed releases cannot be attributed to any particular source, it is reasonable to conclude that there are no “identified sources.”

The HRS requires that the hazardous substances in observed releases by chemical analysis not only be significantly above background level in concentration, but also be in part attributable to the site when the site includes identified sources (see HRS Section 2.3, *Likelihood of release*, “some portion of the release must be attributable to the site”).

The HRS Guidance Manual suggests that this attribution can generally be demonstrated in two steps (page 59). The first step involves showing that the released substances can be associated with the site by documenting their presence in a source or by other documentation regarding site operations indicating the substances were deposited or are present in a source with an HRS containment value greater than zero (see HRS Section 2.2.2, *Identify hazardous substances associated with a source*). When there are multiple possible sources in the vicinity of the site that may be contributing to the significant increase, the second step consists of documenting that some part of the increase is from the on-site source(s). The HRS Guidance Manual states that:

it generally is necessary to obtain sufficient samples between the site being evaluated and other known potential sources (or between the site and adjacent sites) in order to demonstrate an increase in concentration attributable to the site. Additional information may be required if other sites are known to release substances intermittently, such that ‘pulses’ of hazardous substances are created in environmental media.

This guidance suggests information to demonstrate attribution could include information on:

- concentration gradients (e.g., established based on samples from a series of samples between the site and the alternative source),
- flow gradients or other information about the movement of the hazardous substances in the environmental medium of concern, or
- analytical fingerprinting data that establish an association between the site and a unique form of a substance or unique ratios of different substances.

The HRS documentation record at proposal demonstrates that EPA's decision to treat the contaminated sediments as the source is consistent with the HRS (and EPA's interpretation of the term "identified source" in the HRS) and with the guidance discussed above. EPA did examine the area and identified numerous possible original sources as shown in the description of the contaminated sediment source on page 9 of the HRS documentation record at proposal. This description points out that the intensive present and historic use of this Waterway results in many possible sources of the sediment contamination. These uses include industrial and commercial uses from boat building, paper manufacture, aircraft manufacturing operations both immediately adjacent to the Waterway and throughout the watershed for this reach of the Duwamish River, and the possibly hundreds of point source and nonpoint source discharges directly to the Waterway. In addition, there are numerous routes that the contamination can be taking to reach the surface water, including spillage during product shipping and handling, direct disposal or discharge, contaminated groundwater discharge, surface water runoff, storm water discharge, and air deposition. In addition, the sediments in the Waterway itself are constantly being disturbed and transported by tidal influx, by storm water and CSO flow surges, and by the heavy use of the area by vessels, as well as by construction and maintenance at dredging and docking facilities. (See pages 1 and 9 of the HRS documentation record at proposal.)

In fact, the Agency identified so many possible sources that it determined it would be impracticable to establish partial attribution to any particular source within the scope of any type of site assessment, focused or expanded. First of all, it is impracticable to establish background levels between all the possible sources, both because of the number of sources, known, unknown and those no longer present, and because of their proximity to each other. For example, the possible sources associated with industries and commercial endeavors adjacent to the Waterway are also adjacent to and are across from each other, as shown on maps contained in Reference 4 of the HRS documentation record at proposal and submitted by the commenters.

Further, many possible sources not adjacent to the Waterway are in the watershed, and storm water from these areas commingle in uncontrolled or monitored storm drains prior to entry into the Waterway or reach the Waterway via overland flow.

It is not practicable to attribute any particular portion of the contaminated sediment plume to a particular source by establishing concentration gradients, again due to the number of possible sources adjacent to and across the Waterway from each other, as well as to the disturbances in the sediments due to tidal effects, vessel traffic, dredging, and other activities that occur in this major harbor area. Also, establishing concentration gradients requires sufficient samples with consistent gradations in concentrations between possible sources. The lack of any significant distance between sources and the large number of all the possible sources, however, again makes establishing concentration gradients impractical.

Flow gradients also cannot be used to establish attribution. The Waterway is tidal, such that no single flow direction can be identified; releases from a single source are carried both upstream and downstream.

It is also not possible to fingerprint and trace a pattern of contamination to any single source when the number and proximity of the sources are as they are. It is beyond the scope of a screening tool to determine what contaminants were released over time from all the possible sources, let alone the ratios of the contaminants in the releases. The number of samples necessary to develop defensible statistically significant fingerprints for all the possible sources is also prohibitive for a site assessment in this densely developed industrial/commercial area. Further, the large possible number of overlapping fingerprints makes the probability of this activity being successful extremely remote, even if it were possible to obtain this level of information on each possible source. It is likely that many sources may be releasing the same substances, thereby, confounding any chemical ratios.

In addition, the depth of the Waterway varies significantly in cross section, resulting in differential settling of contaminated sediments across the Waterway. Fine particle sediments and sediments with significant amounts of organic matter will settle mainly in undisturbed deeper areas or areas sheltered from currents, because their rate of settling is slower than larger, denser particles. In the dredged channel, the characteristics of the sediments will vary significantly, depending on the time since the last dredging and the amount of vessel traffic. Thus, contaminant concentrations will also vary accordingly. Hence, any attempt to attribute contamination to a single source would have to consider not only the location of the possible source in relation to the contamination, but also the redistribution of the contamination due to differential settling and mixing due to vessel traffic, dredging, tides, and currents.

Commenters did not point to any set of data that would provide a case for partially attributing any specific areas of contamination to particular sources. They speculated that it should have been able to be done, but did not actually provide any documentation doing so. They also did not present or suggest any sampling plan that would achieve attribution of the sediment contamination to sources. The commenters did indicate hot spots in the contamination, and state that there are eight individual contaminated areas, but they did not identify the individual locations of these eight areas. They stated that there are gaps between the locations of samples that meet observed release criteria and that, in these gaps, the sediments are clean. However, simply because the concentrations are not sufficient to identify an observed release does not mean that the gaps represent clean sediments. In fact, as discussed in Section 3.1.3.14 of this support document, only a few samples were found to be not contaminated with man-made contaminants including PCBs, tributyltin and phthalates, and in fact, there are no significant gaps in the contamination.

Even if the commenters had identified specific gaps in the contamination and then significant increases in concentrations in samples adjacent to particular industries, as explained above, this would not suffice to identify observed releases attributable to activities on the adjacent properties. It would still require the identification of specific sources on the facilities, their points of discharge to the Waterway, and that there were no other possible sources between (or across from) the selected background and release samples. Again, the commenters did not provide such information. In fact, on pages ES-3 and 4 of Attachment 18 to Long Painting and Tytanic's comments, a report by King County dated September 20, 2000, is a discussion indicating that one PCB hot spot could possibly be attributed to at least six different sources, some of which no longer exist.

### **3.1.3.14 Continuous Contamination**

DSI, Northland, Long Painting, and Tytanic commented that the sediment plume was not continuous throughout the entire Waterway and that sections of the waterway should not be included in the site because these sections do not need remediation.

DSI and Northland stated that EPA's decision to list six miles of riverfront into one Mega-site is a misuse of EPA's Aggregation Policy. DSI and Northland considered that, based on the information contained in the HRS documentation record, "it is possible that releases to 'hot spots' within the waterway may be attributable to a single generator," and that EPA was "required to evaluate and score the individual sites being included with the Superfund listing." DSI and Northland asserted that it was "likely that these individual sites do not exceed threshold HRS scoring for listing on the NPL." and the "only way to justify the listing of any of these sites is through the improper use of EPA's Aggregation Policy," (citing *Mead Corporation v. Browner* in support of this assertion).

DSI and Northland also claimed that EPA attempted to gloss over isolated hot spots by not including a map showing the locations of the so-called “observed releases” claimed by EPA.

DSI and Northland commented that much of the Waterway did not need remediation and should not be listed because only 20 percent of the Waterway being proposed exceeds SQS (State Sediment Quality Standards), no confirmatory biological testing was done on the Waterway, and the site is naturally attenuating (with the help of ongoing source control efforts). They commented that if EPA would have considered this information, large areas of the Waterway would not exceed the HRS threshold if individually scored, and that EPA should explain why the entire segment identified as the sediment source be listed.

Long Painting and Tytanic claimed that “[i]n basing its HRS scoring on the entire Waterway as a single source of contaminated sediments, EPA also seeks to avoid confrontation with its longstanding ‘Aggregation Policy.’” Long Painting and Tytanic stated that “EPA had arbitrarily and capriciously aggregated multiple non-contiguous sites into one ‘megasite’ for purposes of listing and maximizing natural resource damage opportunities for the Trustees,” and that CERCLA does not permit EPA to “lump low risk sites together with high-risk sites, and thereby to transform one into the other...,” citing *Mead Corp. v. EPA*.

Long Painting and Tytanic commented that the inclusion in the listing of the “properties owned by Tytanic and leased by Long Painting is a classic example of the mischief created when EPA fails to follow the site aggregation requirements set forth in the *Mead* opinion.” Long Painting and Tytanic asserted that near these properties, “no concentration of observed releases set forth in the DR [HRS documentation record] tables is found within nearly one-half mile in either direction of the properties owned by Tytanic.” (In a footnote, Long Painting and Tytanic acknowledges that there are two observed releases nearby, but states that one is an outlier and the analytical result is qualified so shouldn’t be counted. Another release sample, Long Painting and Tytanic argued, is near the Boeing facility and shouldn’t be counted as the location is planned for remediation under a Corrective Action Order.)

Long Painting and Tytanic stated that in setting the background levels differently than at other sediment sites (e.g., not taking highest background concentration as the background level), EPA’s “gamesmanship, which has not been applied by EPA at other sediment sites evaluated for the NPL, is arbitrary and capricious because it masks large, non-contiguous segments of the Waterway for which observed releases have not been fairly established, resulting in misapplication of EPA’s Aggregation Policy.”

In response, sediment contamination was appropriately scored under the HRS. With respect to the commenters’ claim that there are gaps in the contamination, simply because the concentration in a sample is not sufficient to identify an HRS observed release does not mean that the gaps in HRS observed releases represent clean uncontaminated sediments. In fact, many of the released substances (e.g., Bis(2-ethylhexyl)phthalate and PCBs) are man-made substances that simply do not exist in the environment unless they have been released. Hence, any sample containing these substances actually reflects contamination, whether or not they exceed conservative background levels EPA used for establishing observed releases at this site. As noted on page 43 of the HRS documentation record at proposal, in the “case of PCBs, it should be noted that these compounds are not naturally occurring (Ref. 31 p.1). For this reason, the background level can be considered to be 0.”<sup>11</sup>

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<sup>11</sup>EPA notes that it could have taken this approach to establish background levels for identifying observed releases of man-made substances and many more samples would have actually met the criteria for identifying an observed release.



Using the background level of non-detect to establish the presence of contamination of these two man-made substances, any detection establishes the presence of released contamination. Only two samples from the EPA SI (sample numbers DR140 and DR101) between RK2.5 and approximately RK9.5 are non-detect for PCBs and Bis(2-ethylhexyl)phthalate. From non-detect sample DR140 to the RK10.5 mile point (the most upstream point of the site) only 6 samples of 30 are non-detect for these substances. This indicates that contamination is essentially continuous throughout the Waterway. Neither the HRS itself nor the related guidance suggest that total continuity of contamination is necessary in a contaminated sediment source.

Also, the HRS does not require that all samples from a sediment source have to meet the observed release criteria. HRS Section 2.2.1 *Identify source*, only states: “identify the sources at the site that contain hazardous substances.” It does not state that it must contain hazardous substances at observed release levels. That the HRS does not require that all hazardous substances in a source meet observed release criteria to be considered present in the source for scoring purposes is also illustrated in HRS Section 2.2.2, *Identify hazardous substances associated with a source*. This section states “consider those hazardous substances documented in a source (for example, by labels, manifests, oral or written statements) to be associated with that source when evaluating each pathway.”

EPA’s interpretation of the HRS to allow for scoring of such contamination as a single sediment source, despite spaces between observed release samples and despite some non-detect samples, is reasonable. Continuity of observed release samples and the absence of any non-detect samples would not be expected in the Lower Duwamish (or in many waterways with contaminated sediments) because of the various forces that influence deposition of sediment and sorption of contaminants to the sediments. The sediments in the waterway are constantly being disturbed and transported by tidal flux, by storm water surges and CSOs, and by the heavy use of the area by large vessels, as well as by construction and maintenance at dredging and docking facilities (see page 1 of the HRS documentation record at proposal).

Further, even if one viewed the contaminated sediments at the site as consisting of several separate contaminated sediment sources, it would be reasonable to combine the scores for such separate sources in listing the site.<sup>12</sup> The definition of site (Section 1.1 of the HRS, *Definitions*) is:

Area(s) where a hazardous substance has been deposited, stored, disposed or placed, or has otherwise come to be located. Such areas may include multiple sources and may include the areas between sources.

Hence, an HRS site can clearly include multiple areas, multiple sources, and the areas between.

Neither the HRS nor the CERCLA definitions of release and facility specifically address the circumstances under which it is appropriate to combine non-continuous sources in scoring a site. In CERCLA section 105(a)(8)(A), many of the factors that EPA is directed to consider in ranking sites focus on risk to various environmental receptors. The HRS also focuses on the threat posed by the release from multiple sources through the same media. Section 2.2 of the HRS, for example, *Characterize sources*, clearly anticipates multiple sources:

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<sup>12</sup> Doing so would not be inconsistent with Mead Corporation v. Browner, 100 F.3d 152 (D.C. Circuit 1996). The Mead decision invalidated EPA’s attempt to combine a site listed based on an ATSDR health advisory with another site based on the Agency’s aggregation policy. It did not suggest that it would never be appropriate for EPA to define a site as including more than one source. Further, EPA is not relying on the aggregation policy at issue in the Mead case.

Source characterization includes identification of . . . Sources (and areas of observed contamination) at the site [emphasis added]

and further,

For the three migration pathways, identify the sources at the site that contain hazardous substances. Identify the migration pathway(s) to which each source applies. [emphasis added]

Similarly, in HRS section 2.4.2.2, *Calculation of hazardous waste quantity factor value*, the user is instructed to “[s]um the source hazardous waste quantity values assigned to all sources . . . or areas of observed contamination for the pathway being evaluated . . .” Further, in determining what substances to evaluate for purposes of determining waste characteristics factor values for a site, the HRS directs the scorer to consider all substances in any source with a containment value greater than zero for the pathway being evaluated (see HRS Section 2.2.3).

Thus, even if one viewed the contamination as a number of separate sources, the HRS contemplates combining the scores of such sources in listing a site. In determining whether it is appropriate to combine the scores for separate sources to list a single site, EPA believes that it is generally appropriate to consider whether scoring the contamination in such a manner may allow the Agency to be more effective in reducing threats to common targets (targets that are affected by each source) in any future remedial action. This approach is consistent with the focus on risk to targets found in CERCLA section 105(a)(8)(A) and the HRS.

In the Lower Duwamish Waterway, all of the sediment contamination used to score the site should be combined in a single site. First of all, the four targets identified as threatened in the HRS documentation record at proposal are exposed to contamination located anywhere in the Waterway. The human food chain fishery includes the entire Waterway; similarly, the entire waterway is the habitat for a federal threatened species, the Puget Sound Chinook Salmon, and the habitat of a federal candidate species, the Puget Sound Coho Salmon, and the entire Waterway is designated as a migratory pathway critical for the maintenance of anadromous fish species (see pages 53 and 59 of the HRS documentation record at proposal; also see paragraphs below describing the scoring of the Waterway). If certain areas of contamination were left out of the listing and, thus, could not be remediated using fund money, the Agency’s ability to effectively deal with the risk to the targets of concern could be jeopardized. Second, in the Lower Duwamish site, the sediment contamination should be scored together given the issues discussed in connection with the difficulty of attributing the contamination in any specific part of the Waterway to any individual source. The contamination in any part of this sediment source could be coming from any of the possible sources located anywhere along the Waterway.

Regarding the statements by the commenters that it would be unlikely that individual hot spots would qualify independently for the NPL, this is not the case in the Lower Duwamish Waterway. While the commenters did not delineate these hot spots, it is very likely that any significant hot spots would receive an HRS score of at least 28.50. The HRS score of 28.50 requires only a single pathway score of 59. A pathway score in turn is the product of the likelihood of release value multiplied by the waste characteristics value multiplied by the targets values divided by 82,500.

For any area of contamination in the Lower Duwamish Waterway, a surface water pathway score of 59 can be obtained from either the environmental threat or the human food chain threat. For simplicity, this is

illustrated below for the environmental threat alone. (In fact the site score would be greater if both threats were evaluated.)

The likelihood of release value for any observed release to surface water in a hot spot is 550. HRS Section 4.1.2.1.1 *Observed release*, indicates to assign a 550 if an observed release can be established. No commenter claimed that the contaminant levels in these hot spots are not at observed release levels.

The target value for the environmental threat for any location in the Waterway would be 200 based on the presence of three actually contaminated sensitive environments associated with habitats and migratory pathways of Chinook and Coho salmon (pages 5, 59 and 60 of the HRS documentation record at proposal). No commenters challenged the identification or scoring of these targets.

Given the likelihood of release and target scores above, the waste characteristics factor value required to achieve a pathway score of 59 would need to be at or above 44.25 (obtained by using the likelihood of release and target values above and solving for the waste characteristics score, i.e.,  $82,500 \times 59 / (550 \times 200)$ ). The closest possible HRS waste characteristic factor value to 44.25, and still above it, is 56 (HRS Section 2.4.3.2 *Factor category value, considering bioaccumulation potential*, Table 2.7). The waste characteristics value is the product of the ecotoxicity, persistence, and ecosystem bioaccumulation values of any substance associated with a source or in the release and the waste quantity factor value (Section 4.1.4.2.3 of the HRS, *Calculation of the environmental threat-waste characteristics factor category*). In this case, the minimum waste quantity factor value would be 100, because the sensitive environments would be considered actually contaminated targets as they are located in any hot spot area (Section 2.4.2.2 of the HRS, *Calculation of hazardous waste quantity factor value*). Therefore, to obtain a waste characteristics factor value of 56, the combined toxicity/persistence/bioaccumulation value would need to be  $1 \times 10^5$  (see Table 2.7 of the HRS). Fourteen of the hazardous substances associated with the contaminated sediments meet or exceed this requirement (page 56 of the HRS documentation record at proposal),

One of the substances whose combined toxicity/persistence/bioaccumulation value is at or above  $1 \times 10^5$  is PCBs, which was found at observed release levels in 84 of the 88 Boeing samples, in 76 of the NOAA samples, and in 40 of the EPA samples (see Section 2.2.2 of the HRS documentation record at proposal, pages 10 through 39). These samples were located in all parts of the Waterway and in any possible hot spot areas (Reference 7, Figure 6; Reference 8, Figure 3; and Reference 4, Figures 3-1a through d of the HRS documentation record at proposal). In fact, the combined value for PCBs is  $5 \times 10^8$ , and the site score would be 30.

Thus, the site score for any hot spot area of the Waterway based only on the environmental threat of the surface water pathway would certainly be above 28.50.

Regarding the assertion that EPA identified the contaminated sediment as a single source to avoid addressing the aggregation issue, this is not the case. As noted above, given that it is likely that the site score associated with any observed release location would be above 28.50, EPA could have listed any contaminated portion of the Waterway individually; there would have been no need to aggregate the individual areas.

Regarding SQS, biological testing, and natural attenuation, these topics are discussed in Sections 3.1.3.12.6, 3.1.3.12.7, and 3.1.3.12.8 of this support document, respectively. However, as noted above, they would not affect the continuity of the plume for HRS purposes.

### 3.1.3.15 Waste Characteristics

DSI and Northland questioned the evaluation of the toxicity and the bioaccumulation potential in the HRS scoring of the site.

#### 3.1.3.15.1 Toxicity

DSI and Northland pointed out that only surface water sediment samples were used to define the sediment source, and stated that “EPA had overstated the health risk in the HRS scoring report and the claims of risk are not supported by the general scientific literature.” It asserted, in explanation, that “the toxicological database used by EPA in its HRS report was flawed and outdated,” and cited the Superfund Chemical Data Matrix (SCDM), used to support the toxicity value assigned to PCBs for HRS scoring purposes. DSI and Northland asserted that the “SCDM has not been updated since 1996, even though revised toxicological data for PCBs are included in EPA’s Integrated Risk Information System (‘IRIS’). DSI and Northland concluded that “[a]s a result, the HRS score is not an accurate reflection of the human health risk posed by the site.”

In response, the toxicity values used to evaluate this site are contained in the Superfund Chemical Data Matrix (SCDM) (Reference 2 to the HRS documentation record at proposal). As explained in Section 2 of SCDM, the values in this matrix were derived from other EPA databases, such as IRIS and the Health Effects Assessment Summary Tables (HEAST) when such data are available.

The toxicity value associated with PCBs used in the HRS scoring is consistent with the information currently present in IRIS and in SCDM. Section 2.4.1.1 of the HRS, *Toxicity factor*, explains how to determine the toxicity; it states “assign human toxicity factor values to a hazardous substance using Table 2-4. . . .” The RfD value for PCBs in the 1996 version of SCDM is 2.0E-05 (0.00002) mg/kg/day (IRIS). Table 2-4 indicates that for an RfD value less than 0.0005 mg/kg/day, the assigned toxicity factor value should be 10,000. Thus, the assigned toxicity factor value would be 10,000 (as page 50 of the documentation record at proposal notes).

Regarding the comment that this value is out of date, the RfD value for Aroclor 1254, which is a component of the “total PCBs” in the CLP data has not changed in the IRIS database since 1994 (see web-site for information on Aroclor 1254: <http://www.epa.gov/iris/subst/0389.htm#VII>, see also Attachment H). It is still the same value used in the 1996 SCDM; therefore, it would still yield a toxicity factor value 10,000 for PCBs.

Thus, since the RfD value of Aroclor 1254 has remained the same, and it is a component of the total PCBs used in the HRS documentation record as observed release, the assigned toxicity factor value from Table 4-2 of the HRS would remain 10,000.

#### 3.1.3.15.2 Bioaccumulation

DSI and Northland asserted that EPA should refine the food chain bioaccumulation factor value for mercury and PCBs to reflect site-specific studies performed by EPA as part of the Harbor Island Superfund Site - Waterway Operable Unit.

In response, the Agency notes that this comment pertains to the bioaccumulation values used in HRS scoring. The bioaccumulation values used to evaluate this site are contained in the Superfund Chemical Data Matrix

(SCDM) (Reference 2 to the HRS documentation record at proposal). As explained in section 2 of SCDM, the values in this matrix were derived from other EPA databases, such as IRIS and HEAST when such data are available. When the EPA's databases do not contain the necessary information, EPA relies on other databases or uses data from surveys conducted by EPA specifically to develop a database for use with the HRS. The procedures used to convert the information in these sources into the corresponding factor values are identified in the HRS (55 FR 51532, December 14, 1990).

HRS Section 4.1.3.2.1.3 *Bioaccumulation potential*, and Table 4-15 *Bioaccumulation Potential Factor Values*, describe the process. If bioconcentration factor (BCF) data are available for any aquatic human food chain organism, assign a value as follows: a BCF of greater than or equal to 10,000 receives an assigned bioaccumulation potential factor value of 50,000. The bioaccumulation potential factor values in SCDM were derived from the BCF data in Versar, Inc. 1990 *Issue Paper: Bioaccumulation Potential Based on Ambient Water Quality Criteria Documents* (VER\_BCF). The BCF for PCBs is  $6.1\text{E}+04$  for fresh and  $6.7\text{E}+05$  for salt, and the BCF for mercury is  $8.6\text{E}+04$  for fresh and  $4.0\text{E}+04$  for salt (VER\_BCF). Section 4.1.3.2.1.3 of the HRS, *Bioaccumulation potential*, states that if the water body is brackish, use the BCF that yields the higher factor value to assign the bioaccumulation potential factor value to the hazardous substance. The Lower Duwamish Waterway is generally fresh or brackish (page 42 of the HRS documentation record at proposal). Therefore, the BCF for PCBs would be  $6.7\text{E}+05$ , yielding a bioaccumulation potential factor value of 50,000, and the BCF for mercury would be  $8.6\text{E}+04$ , yielding a bioaccumulation potential factor value of 50,000.

Regarding the assertion that EPA should use site-specific studies performed by EPA as part of the Harbor Island Superfund Site - Waterway Operable Unit in determining the bioaccumulation factor values, this option was considered and rejected when EPA revised the HRS. Consistent with the concept that the HRS is a screening tool for ranking sites, EPA carefully examined the possibility of using site-specific fate and transport models in general when revising the HRS (55 FR 51567, December 14, 1990). EPA concluded that, although the use of these types of models

could conceivably increase the accuracy of the HRS for some pathways, collection of the required site-specific data would be far too complex and costly. Fate and transport models are appropriate for a comprehensive risk assessment, but not for a screening tool. In addition, EPA's review suggested that it would be more difficult to achieve consistent results among users of such models than with the HRS.

Therefore, to now use site-specific data to generate bioaccumulation factor values for the Lower Duwamish Waterway site would impair the HRS's ability to make comparisons across sites, particularly for those where such information is not available, and would be inconsistent with HRS sections 4.1.3.2.1.3 for assigning human food chain bioaccumulation factor values and 4.1.4.2.1.3 for assigning ecosystem bioaccumulation factor values.

### 3.1.4 Conclusion

The original HRS score for the Lower Duwamish site was 50.00. Based on the above response to comments the score remains unchanged. The final scores for the Lower Duwamish site are:

Ground Water	Not Scored
Surface Water	100.00
Soil Exposure	Not Scored
Air	Not Scored
HRS Score	50.00

Attachment A - Revised Policy Letter 49

Attachment B - George Town Groundwater Investigation Update

Attachment C - Wycoff/Eagle Harbor Superfund Site Fact Sheet, June 2001

Attachment D - Pacific Sound Resources Record of Decision

Attachment E - Improving Site Assessment: Combined PA/SI Assessments Fact Sheet

Attachment F - Organic SI Data

Attachment G - SI, NOAA, and Boeing Data Sets With Normalized Releases and Overall  
Highest Background Releases for PCBs

Attachment H - IRIS information for Aroclor 1254

Attachment A - Revised Policy Letter 49

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**Attachment A**  
**Revised Policy Letter 49**

MAY-03-01 THU 07:27 AM USACE PORTLAND

FAX NO. 503 808 4905

P. 02



*New guidance*

DEPARTMENT OF THE ARMY  
U.S. Army Corps of Engineers  
WASHINGTON, D.C. 20314-1000

REPLY TO  
ATTENTION OF:

CECW-P/CECW-O

25 APR 2001

## MEMORANDUM FOR COMMANDERS, MAJOR SUBORDINATE COMMANDS

SUBJECT: Implementation Guidance for Section 312 of the Water Resources Development Act of 1990 (WRDA 90), Environmental Dredging, as amended by Section 224 of the Water Resources Development Act of 1999 (WRDA 99)

1. Purpose: This implementation guidance supersedes Policy Guidance Letter No. 42, Section 312 of the Water Resources Development Act of 1990 (WRDA 90), Environmental Dredging, and provides guidance on implementation of Section 312 of WRDA 90 as amended by Section 205 of the Water Resources Development Act of 1996 (WRDA 96) and Section 224 of the Water Resources Development Act of 1999, dated 17 August 1999. This implementation guidance modifies the policy relative to dredging within the boundaries of a site designated by EPA or a state for a response action (either a removal action or a remedial action) under the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. 9601 et seq (CERCLA).

2. Background:

a. Section 312 of WRDA 90. Section 312 authorized the Secretary of the Army to remove contaminated sediments from the navigable waters of the United States. There were two distinct authorities in Section 312. Section 312(a) provided for removal of contaminated sediments outside the boundaries of and adjacent to a Federal navigation project as part of the operation and maintenance of the project. Section 312(b) provided for removal of contaminated sediments for the purpose of environmental enhancement and water quality improvement if such removal was requested by a non-Federal sponsor and the sponsor agreed to pay 50 percent of the cost of removal and 100 percent of the cost of disposal. Section 312 had an annual expenditure limit of \$10 million for Section 312(b) and a 5-year effective life. The authorities of Section 312 expired on 29 November 1995. At the time of its expiration, no environmental dredging projects had been initiated under Section 312 authority.

b. Section 205 of WRDA 96. Section 205 reestablished and amended the authorities of Section 312 by: (1) providing for removal and remediation of contaminated sediments under the authorities of Section 312(a) and Section 312 (b); (2) raising the annual expenditure limit from \$10 million to \$20 million; (3) deleting the termination date for the authorities of Section 312; and (4) giving priority to work at five locations.

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FAX NO. 503 808 4905

P. 03

CECW-AA/CECW-OD

SUBJECT: Implementation Guidance for Section 312 of the Water Resources Development Act of 1990 (WRDA 90), Environmental Dredging, as amended by Section 224 of the Water Resources Development Act of 1999 (WRDA 99)

c. Section 224 of WRDA 99. Section 224 amended Section 312 by (1) changing the non-federal cost sharing from 50 percent to 35 percent; (2) raising the annual appropriation expenditure limit from \$20 million to \$50 million; (3) changing disposal costs to be shared as cost of construction; and, (4) adding three locations to the priority areas. The text of Section 312 as amended is enclosed.

3. General Policy. As a general matter, and consistent with budget priorities, use of the Section 312 authority will be encouraged since the Corps has the expertise to undertake such work and restoration of the Nation's waters is a priority mission area. As a matter of policy, where Section 312 authority is used to remove or remediate contaminated sediments complying with the definition of hazardous substance in the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. 9601 et seq (CERCLA), such removal or remedial action shall not be undertaken unless the Corps obtains reasonable protection from liabilities, which may arise as the result of the removal or remediation. Such actions will be performed in a manner that (1) identifies all potential responsible parties which contributed to the contaminated sediments being removed or remediated, (2) documents all CERCLA hazardous substances, as defined in 42 U.S.C. 9601 (14) that are contained in the contaminated sediments, and (3) pursues cost recovery or other appropriate actions in conjunction with involved federal and state regulatory agencies to assure the "polluter pays" principles of CERCLA are achieved. Removal or remediation at such sites shall be accomplished in consultation with the U.S. Environmental Protection Agency (EPA), non-Federal interests and any identified potential responsible parties. Direct assistance to EPA will continue to be provided on a reimbursable basis for environmental cleanup activities including cleanup dredging and related studies.

4. Policy for Removal and Remediation of Contaminated Sediments Outside the Boundaries of and Adjacent to Federal Navigation Channels (Section 312(a) of WRDA 90, as amended).

a. Implementation of Section 312(a) may be considered where the contaminated material is located outside and adjacent to a Federal navigation channel and contributes to contamination of material in the Federal navigation channel and it can be demonstrated that the costs of removal and remediation, as appropriate, of the contaminated sediment are economically justified based on savings in future operation and maintenance costs and non-monetary environmental benefits. Savings in future operation and maintenance costs are those associated with reduction in dredging and disposal costs through the reduction of contaminated sediment input into the navigation channel. For example, reduction of contaminated sediment may allow continuation or resumption of open water disposal and elimination of the need for more costly confined disposal.

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P. 04

CECW-AA/CECW-OD

SUBJECT: Implementation Guidance for Section 312 of the Water Resources Development Act of 1990 (WRDA 90), Environmental Dredging, as amended by Section 224 of the Water Resources Development Act of 1999 (WRDA 99)

b. Implementation of Section 312(a) will require agreement by a non-Federal sponsor to share in the costs related to the disposal of contaminated sediment under cost sharing prescribed by Section 101 of WRDA 86, as amended, for disposal at facilities for O&M of completed navigation projects. Under this policy, disposal costs are considered those costs not directly related to removal (dredging), remediation (treatment), and transport of the material to reasonably proximate disposal sites; and includes those costs associated with lands, easements, rights of way, retaining dikes, bulkheads, embankments, excavation of subaqueous pits, capping/liner requirements, fish and wildlife mitigation associated with the disposal area, and maintenance and management of the disposal area.

5. Procedures for Removal and Remediation of Contaminated Sediments Outside the Boundaries of and Adjacent to Federal Navigation Channels (Section 312(a) of WRDA 90, as amended).

a. The need to remove and, as appropriate, remediate contaminated sediments outside the boundaries of and adjacent to Federal navigation channels will be identified through dredged material management planning activities.

b. Planning for removal and remediation of contaminated sediments adjacent to Federal navigation channels will include appropriate technical assessments to determine the source(s) of contamination, the areal extent and depth of contamination in areas considered for removal and the time period over which the removal area would remain effectively free of contamination. This assessment will be accomplished in consultation with the Environmental Protection Agency and other appropriate Federal, state and local resource agencies.

c. Planning for removal and, as appropriate, remediation of contaminated sediments adjacent to Federal channels must demonstrate that the recommended cleanup plan is the most cost effective alternative consistent with sound engineering practices and established environmental standards and maximizes net O&M savings considering both Federal and non-Federal costs, provides reasonable protection for potential Corps liability and addresses requirements to assure effect is given to CERCLA's "polluter pays" principle.

d. A feasibility level decision document on removal and remediation of contaminated sediments adjacent to Federal channels will be submitted to HQUSACE for policy compliance review. This report could be a completed dredged material management plan or an interim report. The Operations Division is the dredged material management functional program manager and is responsible for the decision document after HQUSACE policy compliance review is complete.

## CECW-AA/CECW-OD

SUBJECT: Implementation Guidance for Section 312 of the Water Resources Development Act of 1990 (WRDA 90), Environmental Dredging, as amended by Section 224 of the Water Resources Development Act of 1999 (WRDA 99)

c. Based on report (decision document) approval, funding for the contaminated sediment removal and remediation would be sought through the budget process. Funding would be from the Operations and Maintenance, General account. Upon appropriations of funds, negotiation of a PCA will also be completed. Current guidance of the development of an appropriate PCA must be obtained from HQUSACE.

f. The PCA will be submitted to HQUSACE for review and approval including approval by the Assistant Secretary of the Army (Civil Works). Once the PCA is executed, removal and remediation can be initiated.

6. Policy for Removal and Remediation of Contaminated Sediments from the Navigable Waters of the United States for the Purpose of Environmental Enhancement and Water Quality Improvement (Section 312(b) of WRDA 90, as amended).

a. Consistent with Army Civil Works policy and budget priorities, removal and remediation of contaminated sediment from the navigable waters of the United States for the purposes of environmental enhancement (ecosystem restoration) and water quality improvement may be considered for implementation if requested by an appropriate non-Federal sponsor.

b. Implementation of Section 312(b) will require agreement by a non-Federal sponsor to provide 35 percent of the costs of construction, including removal, remediation and transport of the material to reasonably proximate disposal sites. Also, all costs related to the disposal of contaminated sediment, including LERR, are shared as a cost of construction. These requirements are unique to projects under Section 312(b); and the general cost sharing requirements for GNF do not apply. A project under Section 312(b) authority may include removal and disposal of contaminated sediment, removal and remediation of contaminated sediment or remediation of contaminated sediments in place.

c. Priority will be given to work in the following areas:

- (1) Brooklyn Waterfront, New York
- (2) Buffalo Harbor and River, New York
- (3) Ashtabula River, Ohio
- (4) Mahoning River, Ohio
- (5) Lower Fox River, Wisconsin
- (6) Passaic River and Newark Bay, New Jersey
- (7) Snake Creek, Bixby, Oklahoma
- (8) Willamette River, Oregon

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FAX NO. 503 808 4905

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CECW-AA/CECW-OD

SUBJECT: Implementation Guidance for Section 312 of the Water Resources Development Act of 1990 (WRDA 90), Environmental Dredging, as amended by Section 224 of the Water Resources Development Act of 1999 (WRDA 99)

d. Federal expenditures may not exceed \$50 million in a fiscal year to carry out sediment removal and remediation under Section 312(b). There is no per project limit on Federal expenditures under Section 312(b).

7. Procedures for Removal and Remediation of Contaminated Sediments from the Navigable Waters of the United States for the Purpose of Environmental Enhancement and Water Quality Improvement (Section 312(b) of WRDA 90, as amended).

a. If an appropriate non-Federal sponsor requests removal and remediation of contaminated sediments and indicates a willingness and capability to provide the required cost sharing, the removal and remediation project may be considered for a new start for a reconnaissance phase study under the General Investigations account. The budget request will be developed and submitted in accordance with the annual program and budget guidance (Annual Budget EC).

b. Planning for projects to remove and remediate contaminated sediments will be conducted under the two-phase reconnaissance and cost shared feasibility study process. Guidance on the conduct of feasibility studies in ER 1105-2-100 will generally apply except that specific congressional authorization of these projects is not required. Preparation of a feasibility report will meet fully the Section 312(c) requirement for development of a joint plan. Planning for removal and remediation of contaminated sediments should use fully existing sources of information to expedite the study process, provide reasonable protection for the Corps from liability, and address requirements to ensure compliance with the CERCLA's "polluter pays" principle. Sources of information could include dredged material management plans, sediment testing results and other information developed in conjunction with operation and maintenance of Federal navigation projects and the regulatory program.

c. Creative solutions and financial partnerships involving all levels of government should be sought in developing plans for removal and remediation of contaminated sediments. Duplication of Federal programs should be avoided and plans for sediment removal and remediation should recognize appropriate Federal, state and local agency roles. An interagency planning team should be formed to conduct the planning study.

d. Projects for removal and remediation of contaminated sediments will be evaluated and justified as ecosystem restoration projects under the guidance contained in ER 1165-2-501, Ecosystem Restoration in the Civil Works Program.

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CECW-AA/CECW-OD

SUBJECT: Implementation Guidance for Section 312 of the Water Resources Development Act of 1990 (WRDA 90), Environmental Dredging, as amended by Section 224 of the Water Resources Development Act of 1999 (WRDA 99)

c. A feasibility level decision document on projects for removal and remediation of contaminated sediments will be submitted to the Director of Civil Works, ATTN: CECW-B, in accordance with the guidance on policy review of decision documents. Specific Congressional authorization of Section 312 (b) projects is not required but the feasibility report for the project must be approved by the Assistant Secretary of the Army (Civil Works).

f. Based on report (decision document) approval, a construction start for the contaminated sediment removal and remediation project will be sought through the budget process.

g. Based on report approval, preconstruction planning and design (PED) studies will be continued using General Investigations funding. A PED agreement will be executed as a condition for initiation of PED studies. PED costs will be subject to 25 percent cost sharing with the non-Federal share credited toward the non-Federal share of the total project cost.

h. The PCA will be submitted to HQUSACE, ATTN: CECW-B, for review and approval including approval by the Assistant Secretary of the Army (Civil Works).

i. The PCA will be executed and project construction initiated.

8. Permanent Guidance. The guidance in this memorandum is being incorporated into permanent guidance.

FOR THE COMMANDER:



HANS A. VAN WINKLE

Major General, USA

Director of Civil Works

**Section 312 of the Water Resources Development Act of 1990  
as amended by Section 203 of the Water Resources Development Act of 1996  
and by Section 224 of the Water Resources Development Act of 1999.**

**SEC. 312. ENVIRONMENTAL DREDGING.**

**(a) OPERATION AND MAINTENANCE OF NAVIGATION PROJECTS.** - Whenever necessary to meet the requirements of the Federal Water Pollution Control Act, the Secretary, in consultation with the Administrator of the Environmental Protection Agency, may remove and remediate, as part of operation and maintenance of a navigation project, contaminated sediments outside the boundaries of and adjacent to the navigation channel.

**(b) NONPROJECT SPECIFIC.** -

**(1) IN GENERAL.** - The Secretary may remove and remediate contaminated sediments from the navigable waters of the United States for the purpose of environmental enhancement and water quality improvement if such removal and remediation is requested by a non-Federal sponsor and the sponsor agrees to pay 35 percent of the cost of such removal and remediation.

**(2) MAXIMUM AMOUNT.** - The Secretary may not expend more than \$50,000,000 in a fiscal year to carry out this subsection.

**(c) JOINT PLAN REQUIREMENT.** - The Secretary may only remove and remediate contaminated sediment under subsection (b) in accordance with a joint plan developed by the Secretary and interested Federal, State and local government officials. Such plan must include an opportunity for public comment, a description of the work to be undertaken, the method to be used for dredged material disposal, the roles and responsibilities of the Secretary and non-Federal sponsors, and identification of sources of funding.

**(d) DISPOSAL COSTS.** - Costs of disposal of contaminated sediments removed under this section shall be shared as a cost of construction.

**(e) LIMITATION ON STATUTORY CONSTRUCTION.** - Nothing in this section shall be construed to affect the rights and responsibilities of any person under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980.

**(f) PRIORITY WORK.** - In carrying out this section, the Secretary shall give priority work in the following areas:

- (1) Brooklyn Waterfront, New York.
- (2) Buffalo Harbor and River, New York.
- (3) Ashtabula River, Ohio.
- (4) Mahoning River, Ohio.
- (5) Lower Fox River, Wisconsin.
- (6) Passaic River and Newark Bay, New Jersey
- (7) Snake Creek, Hixby, Oklahoma
- (8) Willamette River, Oregon



**Attachment B**  
**George Town Groundwater Investigation Update**



February 1, 2001

**Dear Georgetown Resident or Business Owner:**

As part of the on-going study of groundwater contamination coming from historic practices at 734 South Lucile Street, contaminants have now been detected in groundwater as far west from the facility as Second Avenue and as far south as Fidalgo Street. Burlington Environmental, Inc. (d.b.a. Philip Services) currently owns this Lucile Street site.

The Environmental Protection Agency (EPA) and the Washington State Department of Ecology recently learned of these preliminary findings from Philip Services (Philip). The main contaminants of concern are vinyl chloride and trichloroethene (TCE). Philip will conduct additional testing along East Marginal Way, as well as several other locations, this month.

City-supplied drinking water is not affected by these contaminants. Groundwater, however, should not be used for drinking water or for any other purposes, such as irrigation.

The technical information and results for this recent groundwater study are in a report titled, "Technical Memorandum IV: Results From Supplemental Off-Site Characterization Sampling." This publication, as well as other technical information, can be reviewed at repositories located in Seattle at the Beacon Hill Library at 2519 15<sup>th</sup> Avenue South, or the EPA Regional Office Library at 1200 Sixth Avenue.

Philip Services plans to conduct additional sampling of groundwater and soil gas. The Washington State Department of Health will collect and analyze indoor air samples. To learn more about the next steps for studying and cleaning up groundwater contamination in the Georgetown area, please see the information on the back of this letter. If you have questions, please contact:

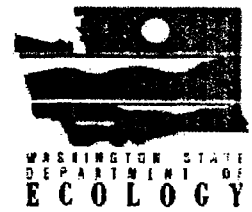
**Jeanne O'Dell**, EPA Community Involvement Coordinator, at 206-553-6919

**Sheila Hosner**, Public Outreach Coordinator, State Department of Ecology, at 425-649-7071

**Curt Hart**, Public Information Officer, State Department of Ecology, at 425-649-7009



**IMPORTANT INFORMATION ABOUT  
GEORGETOWN ENCLOSED**



## Georgetown Groundwater Investigation Update

### **Additional Areas of Contamination Found**

The on-going study of groundwater contamination stemming from historic practices at 734 S. Lucile Street have now revealed contaminants in groundwater as far west from the facility as Second Avenue and as far south as Fidalgo Street. Burlington Environmental, Inc. (d.b.a. Philip Services) currently owns the Lucile Street site.

The Environmental Protection Agency (EPA) and the Washington State Department of Ecology recently learned of these preliminary findings from Philip Services (Philip). The main contaminants of concern are vinyl chloride and trichloroethene (TCE).

### **Additional Testing Scheduled for Adjacent Areas**

Philip plans to conduct additional groundwater and soil gas sampling this month. The Washington State Department of Health will collect and analyze indoor air samples. Locations for sampling will be based on the concentrations of underlying groundwater contamination and whether the buildings have basements that could more easily allow soil vapors to enter indoor air.

In March 2001, Philip Services will propose new monitoring wells for sites west of Denver Avenue and south of Lucile Street. By June 1, 2001, (as proposed in EPA's draft Permit Modification) Philip will submit a report to EPA that analyzes the results from sampling groundwater, soil gas and indoor air.

### **Where Does the Process Go From Here?**

The Environmental Protection Agency is committed to finishing Philip's investigation as quickly as possible, after which alternative cleanup strategies will be developed. EPA will ask for the public to comment on a preferred remedy, then the best remedy for the contamination will be chosen and implemented.

EPA proposes to modify Section VII of Philip Services current permit, which deals with the "corrective actions" required to clean up the groundwater contamination. **Significant changes to this section include a task-by-task enforceable schedule for completing the corrective actions.** Other parts of the existing RCRA permit issued in 1991 remain unchanged.

### **We Want to Know Your Concerns**

The EPA welcomes public comments on the draft permit modification. A 60-day public comment period started with the issuance of the draft permit on January 15, 2001, and will conclude on March 16, 2001. The draft Permit Modification is also available for your review at the Beacon Hill Library or the EPA Regional Office Library. Written comments may be submitted to:

Ed Jones, EPA Project Manager  
1200 Sixth Avenue, MS/WCM-121  
Seattle, WA 98101, or by  
E-mail: [PhilipGeorgetownR10@epa.gov](mailto:PhilipGeorgetownR10@epa.gov)

A public hearing will be held on Thursday, February 15, at 6:30 p.m. at the Eagles Hall located at 6205 Corson Avenue. If you wish to comment in person, please plan to attend. A brief information sharing session will be conducted prior to the hearing.

Information is also available at the EPA web page: <http://yosemite.epa.gov/r10/owcm.nsf/permits/philip-georgetown1>

To ensure effective communication with everyone, additional services can be made available to persons with disabilities by contacting the EPA number listed above.

**Attachment C**  
**Wycoff/Eagle Harbor Superfund Site Fact Sheet, June 2001**

# **SUPERFUND**

## **Fact Sheet**

### **WYCKOFF/EAGLE HARBOR SUPERFUND SITE** *Bainbridge Island, Washington*

 **EPA** U.S. ENVIRONMENTAL PROTECTION AGENCY June 2001

## **Wyckoff's Future: How Will It Be Decided?**

Now that site cleanup is starting to move into high gear, EPA is receiving many questions about the future use of the site. Who owns the land? Could the site be sold in portions? What about sale proceeds? Who decides how the site will be used in the future?

The Wyckoff property has been held in trust (owned) by Pacific Sound Resources Environmental Trust since 1994. Eventual sale of the property will be handled by the Trust. The property must be sold in whole or in portions, subject to applicable law, at the Trust's discretion. After evaluating offers, the Trust will make recommendations to EPA regarding sale of the property. Under the Consent Decree (see box), EPA has final approval authority, on behalf of the Trust beneficiaries, for the sale. EPA will rely strongly on the Trustee recommendation and also will consider the site's assessed value, issues of law, and the value of comparable properties. Trust proceeds are to be paid to EPA to reimburse cleanup costs and to the Natural Resource Trustees to compensate for harm to natural resources.

EPA does not make decisions about future land use at Superfund sites. It is the responsibility of local government, working with affected property owners and other concerned parties, to make land use determinations. EPA's role is to perform cleanup actions that will make the site safe for reasonably anticipated future uses.

*(Continued on page 2)*

### **Consent Decree Created Environmental Trust**

A settlement with the Wyckoff Company (renamed Pacific Sound Resources in 1988) was embodied in a Consent Decree in 1994. The Decree created the PSR Environmental Trust. The heirs of the Wyckoff Company founders, owners and operators placed all ownership rights and shares in the Company into the Trust, to allow the Trust to maximize liquidation of all company assets for the benefit of the environment. The beneficiaries of the Trust are EPA and the four Natural Resources Trustees:

- United States Department of the Interior
- National Oceanic and Atmospheric Administration of the Department of Commerce
- Suquamish Tribe
- Muckleshoot Tribe

A memorandum of agreement was entered into by the beneficiaries to ensure that settlement proceeds would be applied toward both environmental response and natural resource restoration goals.

### **Also in this issue...**

- Lots Of Activity At Wyckoff This Summer
- EPA Considers Public Comment on Potential Buffer Zone
- Site Background
- For More Information

(Continued from Page 1)

Also, EPA can require *institutional controls* at the site, measures to protect the cleanup remedy over the long-term or to prevent possible exposure to contaminants at a site. Institutional controls are non-engineered controls such as easements, covenants, and zoning restrictions that can limit land or resource uses.

EPA has worked closely with the City of Bainbridge Island and the community for years to describe cleanup plans and provide information to support decisions for future land use. EPA has selected residential cleanup standards, the most protective standards, as the cleanup goal at the site. If attained, this level of cleanup would allow for residential, commercial, and/or recreational uses, which gives maximum flexibility to the City for making land use decisions.

## **Lots Of Activity At Wyckoff This Summer**

There will be lots of activity at the Wyckoff site this summer. Following is a re-cap of upcoming site work.

### **Construction**

Construction begins this summer to prepare the site for the steam injection pilot study. EPA will install a vapor cap, injection and extraction wells, instrumentation, and a boiler building. Remaining construction, such as installation of the boiler, pumps, and piping, and treatment plant modifications will begin this fall. The pilot system likely will be online in early 2002 and will operate for one and a half years: a year of steam injection and contaminant extraction, and another 6 months of continued contaminant removal (after the steam is turned off). EPA will take measures to minimize any disturbance during construction and operation of the system. The construction period will be Monday through Friday, with an occasional Saturday, from 7:30 a.m. to 5:00 p.m.

Truck traffic will be limited because construction materials will be delivered by barge. Truck access during construction will be through the Taylor Avenue road. Signs will be posted to caution local drivers about trucks crossing. The highest period of truck traffic is anticipated during the months of July and August.

### **Water Well Installation**

Beginning in late July and extending through August, EPA will drill a well on the site to serve as the water source for pilot study operations. EPA made this decision after discussing water supply options with the interested parties, including the City of Bainbridge Island, Suquamish Tribe, Association of Bainbridge Communities, Natural Resource Trustees, and others. EPA considered cost, reliability, feasibility, schedules, and environmental impact in determining that the well was the best option for supplying water to the pilot plant. EPA will re-evaluate use of the well during remedial design for the full scale project.

EPA plans to limit the use of well water by recycling process water. By installing a cooling tower, we can reduce the system's water needs to as low as 20-70 gallons per minute.

EPA will conduct pumping tests during construction of the on-site well to ensure that our use of this well will not impact nearby wells at Bill Point, Eagledale, and Taylor Avenue. EPA will also monitor these same nearby wells during operation of the pilot system to ensure continued integrity of the groundwater aquifer system.

## Cleanup of Former Log Storage/Peeler Area

After about 10,000 cubic yards of contaminated soil is excavated in July and August, the Former Log Storage/Peeler Area on the western portion of the site can be called clean. Excavated areas will be backfilled with clean soil, and contaminated soil will be moved to the Former Process Area for eventual treatment. Measures will be employed during excavation and backfill activities to minimize airborne dust.

## Capping

Last construction season, EPA placed a 3-5 foot thick cap over a 15-acre area extending the existing 50-acre clean sediment cap to the shoreline of the Wyckoff property. During this construction season (August 15, 2001 to February 15, 2002), EPA will complete the East Harbor capping process by placing clean material near the shoreline to create a gently sloping new beach in front of a 500 foot section of the sheet pile wall. This new beach area will link the habitat beach created last season with beach areas around the rest of the site. Construction will likely take less than one month. The exact start date for construction has not yet been determined.

## EPA Considers Public Comment on Potential Buffer Zone

In the March, 2001 EPA Wyckoff/Eagle Harbor fact sheet, EPA solicited public comment on the potential use of vegetated "buffer" areas along the Wyckoff shoreline after cleanup. The intent of these buffer areas is to separate critical habitat from nearby development and human activity, and to ensure that the cleanup remedy and mitigation area are protected. Buffers also reduce impacts from stormwater runoff and provide essential habitat and nutrients for fish and coastal organisms.

EPA received 17 comment letters and e-mails concerning the potential use of vegetated buffers at the Wyckoff site. Sixteen of the comment letters and e-mails received were strongly in favor of the concept to protect intertidal and subtidal areas created or enhanced by the cleanup, and to create shoreline habitat. The comment letters in favor of buffer zones at the site included resolutions from the Bainbridge Island City Council and the Bainbridge Island Park & Recreation District. One e-mail was generally opposed to the concept, noting that buffer zones could take a significant amount of upland area away from future development. In addition to the public comment letters and e-mails received during the comment period, EPA also received correspondence from the Suquamish Tribe, the

National Marine Fisheries Service of NOAA, the U.S. Fish and Wildlife Service, and the Washington State Fish and Wildlife Service calling for and strongly advocating the creation of buffer zones at the Wyckoff site.

EPA believes that the functions provided by buffer zones are critical to the long term protection of the cleanup remedy and mitigation area at the site. In line with the sentiments expressed by the public and the Natural Resource Trustee agencies, EPA will draft a Preliminary Institutional Controls Plan (ICP) in the near future. The ICP will detail performance standards that must be met by the landowner under local control and oversight, to protect the intertidal and subtidal areas which are part of the site's cleanup remedy. While more detail will be provided in the ICP, performance standards for future use of the site will generally include the following:

- There must be adequate separation between intertidal habitat and upland human activity;
- Impacts to intertidal areas from stormwater runoff, including erosion and contaminant transport, must be prevented; and

- Essential habitat for fish, intertidal organisms, and upland shoreline wildlife for feeding, breeding, rearing and cover must be provided and maintained.

The detailed performance standards to be included in the Preliminary ICP will address the protection of intertidal areas around the entire property. Although a limited vegetated buffer (about 10 to 15 feet in width from the top of the shoreline) for the newly created habitat beach on

the western portion of the property will be planted this fall as part of mitigation for site cleanup, this measure may be modified in the future by the landowner to comply with specific ICP performance standards.

EPA would like to thank all members of the public that provided comments on this issue. The Preliminary ICP should be available in the information repository by the end of August, 2001.

### **Site Background**

EPA listed Wyckoff/Eagle Harbor as a Superfund site in 1987. The former Wyckoff wood treating facility, located at the mouth of Eagle Harbor on Bainbridge Island, operated from the very early 1900's to 1988. Soils at the facility, and groundwater beneath the facility, are severely contaminated. Contaminants include creosote and other wood treatment compounds. About 1 million gallons of creosote product remains in the site's soil and groundwater. These contaminants pose a risk to public health and the environment.

A groundwater extraction and treatment system has been operated on site since 1990. However, contaminants were still moving into the marine environment until the sheet pile wall was installed in 2001. EPA will use thermal treatment technologies to clean up remaining soil and groundwater contamination.

In Eagle Harbor, bottom sediments were severely contaminated with chemicals from wood-treating and shipyard operations. A public health advisory recommends against eating fish and shellfish from the harbor. Contaminated sediments in various locations were capped with clean material in 1994, 1997, and 2000. Capping continues.



## **For More Information**

### **Hanh Gold**

EPA Project Manager

Wyckoff Groundwater and Soils (Thermal Treatment, Sheet Pile Wall)

(206) 553-0171

E-mail: gold.hanh@epa.gov

### **Ken Marcy**

EPA Project Manager

Eagle Harbor (Habitat Mitigation, Capping)

(206) 553-2782

E-mail: marcy.ken@epa.gov

### **Andrea Lindsay**

EPA Community Involvement Coordinator

(206) 553-1896

E-mail: lindsay.andrea@epa.gov.

### **Toll-Free Telephone Number**

1-800-424-4372

### **EPA Web Site:**

[www.epa.gov/r10earth/](http://www.epa.gov/r10earth/)

click on "index" at the bottom

click on "W" for Wyckoff

**Documents:** The Administrative Record is a file that contains all information used by EPA to make decisions on the cleanup actions from the beginning of the site's history. The Administrative Record can be reviewed at the EPA Records Center, 7th Floor, 1200 Sixth Avenue, Seattle. Call 206/553-4494 to make an appointment. Select documents can be viewed at the Information Repository located at the Bainbridge Island Public Library, 1270 Madison Avenue North. If the library does not have the document you need, feel free to call Andrea Lindsay, EPA Community Involvement Coordinator, at (206) 553-1896.

*Additional services can be made available to persons with disabilities by calling EPA toll-free at 1-800-424-4372 or (206) 553-1200..*

## **Inside:**

**Wyckoff's Future: How Will It Be Decided?**

**Lots Of Activity At Wyckoff This Summer**

**EPA Considers Public Comment on Potential Buffer Zone**

**Site Background**

**For More Information**



Region 10 (ECO-081)  
1200 Sixth Avenue  
Seattle WA 98101

PRSRT STD

US POSTAGE  
PAID  
#G-35  
SEATTLE, WA

SUPERFUND FACT SHEET  
WYCKOFF/EAGLE HARBOR SUPERFUND SITE  
Bainbridge Island, Washington

**Attachment D**  
**Pacific Sound Resources Record of Decision**

**Pacific Sound Resources Record of Decision—Marine Sediments Unit**  
**Table 23—Estimated Schedule of Available Capping Material**

Source Location	Percent Sand	1999	2000	2001	2002	2003	2004	2005
Duwamish River: Upstream of Settling Basin	70-90%	40,000 CY	0	40,000 CY	0	40,000 CY	0	40,000 CY
Duwamish River: Lower Reach	<50%	100,000 CY	0	100,000 CY	0	100,000 CY	0	100,000 CY
Snohomish River: Upper Reach	90%	0	0	0	240,000 CY	0	0	240,000 CY
Snohomish River: Lower Reach	70%	0	0	240,000 CY	0	240,000 CY	0	240,000 CY
Everett Home Port	70% (est.)	0	150,000 CY	0	0	0	0	0
Annual Volume of Sandy Material (excludes lower Duwamish River)		40,000 CY	150,000 CY	280,000 CY	240,000 CY	280,000 CY	0	320,000 CY
Annual Total Volume		140,000 CY	150,000 CY	380,000 CY	240,000 CY	380,000 CY	0	420,000 CY
Cumulative Volume of Sandy Material (excludes lower Duwamish River)		40,000 CY	190,000 CY	470,000 CY	710,000 CY	890,000 CY	890,000 CY	1,210,000 CY
Cumulative Total Volume		140,000 CY	290,000 CY	670,000 CY	910,000 CY	1,290,000 CY	1,290,000 CY	1,710,000 CY

CY = Cubic Yard.

Dredge Material from Upper Snohomish River may not be available until 2002 due to existing commitments.

Available quantities are variable depending on runoff and dredging requirements.

**Attachment E**  
**Improving Site Assessment: Combined PA/SI Assessments Fact Sheet**



# Improving Site Assessment: Combined PA/SI Assessments

Office of Emergency and Remedial Response  
Site Assessment Team

Quick Reference Guidance Series

## ABSTRACT

The U.S. Environmental Protection Agency's (EPA's) Office of Emergency and Remedial Response (OERR) encourages the regions to combine Preliminary Assessment (PA) and Site Inspection (SI) activities, or conduct Integrated Assessments (IAs), to reduce repetitive tasks and ultimately costs. As is the case with its individual components, a combined PA/SI assessment is performed to determine what steps, if any, need to occur next at a site. This guidance document discusses elements and reporting requirements during each phase of the combined PA/SI assessment and supplements existing PA and SI guidance.

## BACKGROUND

The *National Oil and Hazardous Substances Pollution Contingency Plan* (NCP) (40 CFR Part 300) requires that EPA perform a preliminary assessment (PA) on all sites entered into the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS). A detailed site inspection is required if site conditions warrant. These investigations are intended to:

- (1) Eliminate from consideration those sites that pose no threat to public health or the environment;
- (2) Determine the potential need for a removal action;
- (3) Set priorities for future investigations; and
- (4) Gather existing or additional data to facilitate later components of the site assessment process.

Later components include either a Hazard Ranking System (HRS) evaluation or a remedial investigation/feasibility study (RI/FS). These objectives and the means for achieving them are discussed in NCP section 300.420.

Site assessment experience has shown that combined site assessment activities can reduce repetitive tasks and ultimately reduce costs at sites clearly warranting an SI before a full PA is completed. By combining PA and SI activities (e.g., background search, information gathering and file review, field reconnaissance, field sampling, and

reporting requirements), the site assessment process is streamlined, reducing tasks to one continuous site investigation.

## WHAT IS A COMBINED PA/SI ASSESSMENT?

The combined PA/SI assessment integrates activities typically performed during the PA (information gathering, site reconnaissance) with activities typically performed during the SI (review of data, development of field work plans, field sampling, filling data gaps) to achieve one continuous site investigation.

Combined PA/SI assessments are different than integrated assessments. While combined PA/SI assessments combine Superfund remedial phases (e.g., PA and SI), integrated assessments integrate activities under both Superfund removal and remedial programs. For information on integrated remedial and removal site assessments, see the document *Improving Site Assessment: Integrating Removal and Remedial Evaluations*<sup>1</sup>.

## WHEN IS A COMBINED PA/SI ASSESSMENT APPROPRIATE?

In the initial phases of a PA (or even before conducting the PA), the site investigator frequently discovers (through experience and professional judgment) that information

beyond the scope of a typical PA will be needed. Rather than continuing with traditional PA activities and producing a final PA report, PA activities can be combined with field sampling activities of the SI to produce a combined PA/SI.

The combined approach may be appropriate for any site entered in CERCLIS or sites that are brought to our attention by a citizen's petition. Considerations such as the amount of available information and time and resource constraints may affect an investigator's decision as to what type of PA to conduct. In addition to the traditional PA, the combined PA/SI, and IA assessment, you may also elect to conduct an abbreviated PA (APA). For information on APAs, see the guidance document titled *Improving Site Assessment: Abbreviated Preliminary Assessments*<sup>2</sup>. For information on IAs, see the guidance document titled *Improving Site Assessment: Integrating Removal and Remedial Site Evaluations*<sup>1</sup>. Each type of PA may lead to a decision that no further Superfund action is required at the site, and to subsequent archival from CERCLIS. Alternatively, each type of PA may lead to the collection of the more detailed information gathered in the SI stage of the process.

#### HOW DO I CONDUCT A COMBINED PA/SI ASSESSMENT?

You conduct the combined PA/SI assessment to streamline the site assessment process by formulating and testing hypotheses that meet the requirements of both PA and SI activities and producing one report. Although the PA and SI are combined, you must still meet the requirements of both actions as stated in the NCP (see Attachment A). (See also *Guidance for Performing Preliminary Assessments Under CERCLA*<sup>3</sup> and *Guidance for Performing Site Inspections Under CERCLA*<sup>4</sup> for detailed information on investigating and reporting requirements.)

In the first phase of the PA process, you will determine whether the site is eligible for evaluation under CERCLA. Criteria for determining this are identified below (from guidance document titled *Improving Site Assessment: Pre-CERCLIS Screening Assessments*<sup>5</sup>).

Gather enough data to address the screening criteria below, to help make a CERCLIS entry decision. These criteria are primarily based on OERR Directive # 9200.4-05.

A site should not be entered into CERCLIS if:

- The site is currently in CERCLIS, or has been removed from CERCLIS (archived) and no new

data warrant CERCLIS entry. Determine whether the site has previously been evaluated under the Federal Superfund Program to avoid entering a duplicate site record into CERCLIS. Check CERCLIS and archive data for previous entries of a site using site name, location, and site identification number data.

Note: Sites already in CERCLIS with no work started may warrant CERCLIS screening as part of an APA. (See guidance document titled, *Improving Site Assessment: Abbreviated Preliminary Assessments*<sup>2</sup> for more information on conducting APAs.)

- The site and some contaminants are subject to certain limitations based on definitions in CERCLA. This includes cases where the release is:
  - (1) Of a naturally occurring substance in its unaltered form, or altered solely through naturally occurring processes or phenomena, from a location where it is naturally found;
  - (2) From products that are part of the structure of, and result in exposure within, residential buildings or business or community structures; or
  - (3) Into public or private drinking water supplies due to deterioration of the system through ordinary use.
- A State or Tribal remediation program is involved in response at a site that is in the process of a final clean-up (e.g., a State Superfund program, State voluntary clean-up program, and State or local Brownfields programs).

During the screening process, a file search of other Agency programs eliminates sites where other programs are actively involved. Based on the search of the geographical location of the site and the site name, conduct the search using current databases or telephone calls to staff of other potentially involved programs. You, in consultation with State and Tribal program representatives, are responsible for determining whether another program is actively involved with the site.

When another program with sufficient investigation, enforcement, and remediation resources is actively involved with a site, postpone a decision on CERCLIS entry until all actions have been completed. EPA is responsible for determining if the actions are sufficient and will then determine whether any further Superfund involvement is warranted.

- The hazardous substance release at the site is regulated under a statutory exclusion (e.g., petroleum, natural gas, natural gas liquids, synthetic gas usable for fuel, normal application of fertilizer, release located in a workplace, naturally occurring, or covered by the Nuclear Regulatory Commission (NRC), and Uranium Mill Tailings Radiation Control Act. See CERCLA Section 101(22).
- The hazardous substance release at the site is deferred by policy considerations (e.g., RCRA Corrective Action). Refer to the *Regional QC Guidance for NPL Candidate Sites*<sup>6</sup> for more examples.

The site investigator should, at a minimum, search other current EPA data sets using site identification data (name and location) to determine whether the site is already being addressed by other authorities.

The NPL/RCRA deferral policy states that sites should not be placed on the NPL if they can be addressed under RCRA Subtitle C corrective action authorities. However, according to the NPL/RCRA policies published June 10, 1986 (51 FR 21057), June 24, 1988 (53 FR 23978), and October 4, 1989 (54 FR 41000), facilities that are subject to RCRA Subtitle C may be listed on the NPL when corrective action is unlikely to succeed or occur promptly, as in the following situations: (1) inability to finance, (2) unwillingness/loss of authorization to operate, (3) unwillingness/case-by-case determination, (4) converters, non- or late filers, (5) pre-HSWA (Hazardous and Solid Waste Amendments) permittees, and (6) when not all of the release from the facility is covered by RCRA corrective action.

- Site data are insufficient to determine CERCLIS entry (i.e., based on potentially unreliable sources or with no information to support the presence of hazardous substances or CERCLA-eligible pollutants and contaminants).

If you are presented with an incomplete checklist, or a checklist with what appears to be unreliable data, you should identify the data deficiencies and forward these data needs to the site investigator for further data collection. For more information, see the Pre-CERCLIS Screening Assessment Checklist/Decision Form in the guidance document titled *Improving Site Assessment: Pre-CERCLIS Screening Assessments*<sup>5</sup>. When it is not feasible to obtain all the information to complete the checklist,

use professional judgement when deciding to place a site in CERCLIS.

- There is sufficient documentation that clearly demonstrates that there is no potential for a release that could cause adverse environmental or human health impacts (e.g., comprehensive remedial investigation equivalent data showing no release above applicable or relevant and appropriate requirements (ARARs), completed removal action of all sources and releases, or a completed EPA approved risk assessment showing no risk).

If the answer is “yes” to any of these items and there is no other Federal Superfund interest, you should assign the site a No Further Remedial Action Planned (NFRAP) designation or defer it to another program. This decision should be documented in a brief APA report (reporting requirements are described below). This action terminates the PA process. If the answer is “no” to any of the bulleted items, you may proceed to the next phase of the PA process, the initial site evaluation.

The following four steps should be taken during the course of the combined PA/SI assessment.

#### **Step 1 -- Starting the Combined PA/SI Assessment**

Site investigators may begin the combined PA/SI assessment in the traditional PA process or may plan it as a combined PA/SI assessment following discovery. The combined PA/SI assessment begins when either: (1) you collect data and perform other tasks related to development of the combined PA/SI report; (2) you sign a letter, form, or memorandum to your contractor or State/Tribal government requesting performance of a combined PA/SI assessment at a specific site or group of sites; or (3) you receive written confirmation from a State/Tribal government that the State/Tribal government will conduct the combined PA/SI assessment.

#### **Step 2 -- Initial Review and Planning:**

##### *A. CERCLIS Tracking*

Refer to the Superfund Program Implementation Manual (SPIM) for data management issues.

##### *B. Conducting the File Review*

Before conducting the file review, be aware of the data needs for both the PA and the SI so that you can collect data at one time for use throughout the site investigation. The information needs of the PA are listed in *Guidance for Performing Preliminary Assessments Under CERCLA*<sup>3</sup>, page 14. You should review these needs, as well as analytical data needs of the SI, before and during the file review phase. Identify data gaps so that reviews can be



focused on finding crucial information. Assess whether information:

- Helps characterize site sources;
- Supports testing of site hypotheses;
- Provides information for HRS site scoring;
- Guides further sampling and analysis;
- Indicates a need for emergency response actions; and
- Indicates health and safety concerns.

The types of information that you should collect and the typical locations where you can find the information are listed in the *Guidance for Performing Preliminary Assessments Under CERCLA*<sup>3</sup>, pages 21 to 27 and in the *Guidance for Performing Site Inspections Under CERCLA*<sup>4</sup>, chapter 3.

### **Step 3 -- Field Activities and Documentation:**

#### **A. Site Reconnaissance**

A site reconnaissance often involves a preliminary viewing of the site to observe source areas and possible evidence of releases of hazardous substances. In some instances, depending on necessity and practicality, an on-site reconnaissance is performed at the PA stage. During a combined PA/SI assessment, an on-site reconnaissance would identify sources and possible targets and begin planning sampling activities. Information on site reconnaissance and field investigation planning can be found in the *Guidance for Performing Preliminary Assessments Under CERCLA*<sup>3</sup>, section 2.5 and in the *Guidance for Performing Site Inspections Under CERCLA*<sup>4</sup>, chapter 2.

#### **B. Developing HRS-based Decision Making**

To develop a preliminary HRS score for the site, collect information and analytical data to determine the likelihood of release, waste characteristics, and targets associated with that site. To that end, look for information indicating, but not limited to, whether:

- A release of CERCLA hazardous substances is documented, either through sampling or observing substances entering a media of concern;
- The hazardous substances at the site are of sufficient toxicity and quantity to represent a risk to human health or the environment, as defined by CERCLA; and

- There are human or environmental targets actually or potentially exposed to releases or potential releases of hazardous substances from the site.

A detailed explanation of each of the above scoring factors, organized by pathway, is found in the NCP, Appendix A (the HRS) and in the *Hazard Ranking System Guidance Manual*<sup>5</sup>. In addition, various tools are available to assist you in developing a preliminary score before the field activities are initiated. This includes PA-Score, which is an automated method of scoring used to test various scoring scenarios.

For those sites that do not receive a preliminary HRS score of 28.50 or greater, prepare an APA report to the site file detailing the rationale for not sampling. In this report, explain why the site poses insufficient human health and/or the environmental risk to warrant further investigation under CERCLA and list the factors that influenced this decision.

#### **C. Developing the Sampling Plan**

For all sites that indicate a preliminary HRS score of 28.50 or greater, field data collection and field sampling will be required to prove the hypothesis. During an on-site reconnaissance, plan sampling locations to ensure that evidence of the presence and migration of CERCLA hazardous substances is documented. An explanation of field sample planning can be found in the *Guidance for Performing Site Inspections Under CERCLA*<sup>4</sup>, chapter 3.

#### **D. Performing Field Work**

Once you determine that site sampling is needed, field work plans (e.g., sampling, quality assurance, health and safety) will be developed and field work should begin. A detailed explanation of how to conduct field work under CERCLA is in the *Guidance for Performing Site Inspections Under CERCLA*<sup>4</sup>, chapters 3, 4, and 5.

### **Step 4 -- Final Review and Documentation:**

#### **A. Evaluating Data and Preparing a Revised HRS Score**

After field work has been performed and media samples have been analyzed, evaluate the data generated by the laboratory (e.g., hazardous substance concentrations, data validation information), along with other field and file data, to determine its usability for HRS scoring. Review field and file information and sampling data to determine whether they meet HRS requirements.

Enter these data into a scoring model to determine whether earlier hypotheses are correct and whether the site score is greater than 28.50. Document the score on HRS scoresheets.

### *B. Preparing the Combined PA/SI Report*

Prepare the combined PA/SI report upon completion of all field and analytical activities, including those elements required in a typical PA report and the more detailed information that would typically be included in an SI. For example, begin the combined PA/SI report with an introduction describing the investigation performed at the site and state that the report serves as documentation of the performance of a combined PA/SI.

Describe the site, its operation, and waste practices and discuss the field work and resulting analytical data. Provide conclusions on the status of the site and recommendations for further investigation. For a detailed description of elements to include in the combined PA/SI report, refer to the *Guidance for Performing Preliminary Assessments Under CERCLA*<sup>3</sup> section 4.0 and the *Guidance for Performing Site Inspections Under CERCLA*<sup>4</sup> chapter 6.

### **WHAT ARE THE REPORTING REQUIREMENTS FOR THE PA/SI PROCESS?**

Document each milestone within the combined PA/SI assessment process to ensure that it meets the requirements of the NCP. Combined PA/SI assessment start dates are required as an internal planning measure. Include planning documents, HRS score sheets, the combined PA/SI assessment checklist, and a final report to document the decision making process.

#### **What Data is Required to be Reported?**

Include a letter, form, or memorandum in the site file to your contractor or State/Tribal government (or written confirmation from a State/Tribal government) documenting that a combined PA/SI assessment will be performed.

- Show in the file that you performed an investigation to determine whether the site is being handled under another EPA or State/Tribal program.
- If during the course of the combined PA/SI assessment you determine that the hypothesis is incorrect and no further investigation is warranted, provide appropriate documentation, such as an APA report. The report should include the rationale behind the NFRAP decision.
- After completing the combined PA/SI assessment, prepare a final report as described above.

### **How Will the Information be Managed?**

CERCLIS/WasteLAN is the official national information management system for the Superfund program. Site assessment data must be entered into CERCLIS/WasteLAN and regularly updated to effectively and efficiently manage Superfund's site assessment process. Please refer to the latest version of EPA's SPIM and CERCLIS/WasteLAN Coding Guidance Manual for instructions on entering combined PA/SI assessment information into CERCLIS/WasteLAN.

### **REFERENCES**

1. U.S. Environmental Protection Agency, Pending Publication. Quick Reference Guidance Series - *Improving Site Assessment: Integrating Removal and Remedial Site Evaluations*.
2. U.S. Environmental Protection Agency, October 1999 Quick Reference Guidance Series - *Improving Site Assessment: Abbreviated Preliminary Assessments*. Publication 9375.2-09FS.
3. U.S. Environmental Protection Agency, September 1991. *Guidance for Performing Preliminary Assessments Under CERCLA*. Office of Emergency and Remedial Response. Publication 9345.0-01A.
4. U.S. Environmental Protection Agency, September 1992. *Guidance for Performing Site Inspections Under CERCLA*, Office of Emergency and Remedial Response. Directive 9345.1-05.
5. U.S. Environmental Protection Agency, October 1999. Quick Reference Guidance Series - *Improving Site Assessment: Pre-CERCLIS Screening Assessments*. Publication 9375.2-11FS.
6. U.S. Environmental Protection Agency, December 1991. *Regional Quality Control Guidance for NPL Candidate Sites*. Office of Solid Waste and Emergency Response. Publication 9345.1-08.
7. U.S. Environmental Protection Agency, November 1992. *The Hazard Ranking System Guidance Manual*. OSWER Office of Solid Waste and Emergency Response. Directive 9345.1-07.

### **FOR MORE INFORMATION**

For more information on combined PA/SI assessments, please contact Frank Avvisato at EPA Headquarters, (703) 603-8949 or e-mail at [avvisato.frank@epa.gov](mailto:avvisato.frank@epa.gov).

**ATTACHMENT A**  
**COMBINED PA/SI ASSESSMENT CHECKLIST**

## COMBINED PA/SI ASSESSMENT CHECKLIST

Activities performed during a combined PA/SI assessment must still meet the requirements of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) listed below. This checklist can be used to assist you in determining whether the combined PA/SI assessment meets the requirements and is designed to accompany the final PA/SI report. The items listed below can be found in section 300.420 of the NCP.

**Checklist Preparer:**

\_\_\_\_\_  
 (Name/Title) \_\_\_\_\_ (Date) \_\_\_\_\_  
 (Address) \_\_\_\_\_ (Phone) \_\_\_\_\_  
 (E-Mail Address) \_\_\_\_\_

**Site Name:**

\_\_\_\_\_

**Previous Names (if any):**

\_\_\_\_\_

**Site Location:**

\_\_\_\_\_  
 (Street) \_\_\_\_\_  
 (City) \_\_\_\_\_ (ST) \_\_\_\_\_ (Zip) \_\_\_\_\_

**Latitude:**

\_\_\_\_\_

**Longitude:**

\_\_\_\_\_

**Complete the following checklist. If "no" is marked, please explain below.**

	YES	NO
1. Does the site appear in CERCLIS?	<input type="checkbox"/>	<input type="checkbox"/>
2. Has a review of existing information about the release, such as pathway(s) of exposure, targets, sources, and nature of the release been performed?	<input type="checkbox"/>	<input type="checkbox"/>
3. Has an off-site reconnaissance been performed?	<input type="checkbox"/>	<input type="checkbox"/>
4. Has a sampling and analysis plan been developed that provide a process for obtaining data of sufficient quality and quantity to satisfy data needs?	<input type="checkbox"/>	<input type="checkbox"/>
5. Does the sampling and analysis plan include:		
a) A field sampling plan, which describes the number, type, and location of samples, and the type of analyses, and	<input type="checkbox"/>	<input type="checkbox"/>
b) A quality assurance project plan, which describes policy, organization, and functional activities, and the data quality objectives and measures necessary to achieve adequate data for use in site evaluation and hazard ranking system activities?	<input type="checkbox"/>	<input type="checkbox"/>
6. Once the combined PA/SI report has been prepared, are the following elements included?		
a) A description/history/nature of waste handling	<input type="checkbox"/>	<input type="checkbox"/>
b) A description of known contaminants	<input type="checkbox"/>	<input type="checkbox"/>
c) A description of the release	<input type="checkbox"/>	<input type="checkbox"/>
d) A description of the probable nature of the release	<input type="checkbox"/>	<input type="checkbox"/>
e) A description of pathways of migration of contaminants	<input type="checkbox"/>	<input type="checkbox"/>
f) An identification and description of human and environmental targets	<input type="checkbox"/>	<input type="checkbox"/>
g) A recommendation on whether further action is warranted (separate letter report)	<input type="checkbox"/>	<input type="checkbox"/>

**Please provide a brief explanation for "no" responses shown above:**

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

\_\_\_\_\_  
 Checklist Preparer Name/Signature/Date

\_\_\_\_\_  
 EPA Regional Reviewer/Date

**Attachment F**  
**Organic SI Data**

This attachment documents that observed releases by chemical analysis could still be identified if the analytical data used to identify observed releases from the 1998 EPA SI data set (References 4 and 6 of the HRS documentation record at proposal) for organics using the highest background level for each substance for all of the background samples identified in the HRS documentation record at proposal. This attachment also contains data for the correlation of percent fines and organic hazardous substance and percent TOC and organic hazardous substance.

Information in this attachment was obtained from HRS documentation record at proposal References 4 and 6 (Ref. 4 pp. 534-736 and 848-898). The second row across of the organic SI data table contains the highest background concentration (found in the bottom half of the table labeled BG for each substance), multiplied by three per HRS Table 2-3 *Observed Release Criteria for Chemical Analysis*. For example the highest background concentration for anthracene is sample DR274 at 90 µg/kg and three times that is 270; therefore any sample that has a concentration of anthracene of 270 µg/kg or greater would qualify as observed release (i.e., sample DR016 with a concentration of anthracene of 320 µg/kg). Observed releases were determined by comparing the contaminant concentration of the sample to three times the highest background level for that sample, all shaded concentrations still meet the qualifications for observed release by chemical analysis.

- The first column is the sample number.
- The second column, *Type* indicates if the sample was a release sample (release) or a background sample (BG) in the HRS documentation record at proposal (see pages 10-30 of the HRS documentation record at proposal).
- In the third column *Highest Release* a 1 indicates that the sample was an observed release sample in the documentation record at proposal and would still qualify for an observed release if the overall highest background level, from all the background samples in the documentation record at proposal, was used. An asterisk in this column indicates that while the sample qualifies for an observed release, it was not included in the documentation record at proposal, these samples will not be included as part of the discussion of observed releases for the Waterway.
- The fourth column *% fines* contains the percent of fine present in that sample;
- The fifth column *% TOC* contains the percent of TOC present in that sample.
- The remaining columns contain the contaminant followed by *Q* which indicates if the sample is qualified or not, concentrations are in µg/kg. Samples that are shaded meet the criteria for an observed release for at least one substance. Substance concentrations that are shaded meet the criteria for an observed release.

The correlation between particle size (% fines) and contaminant and percent TOC and contaminant were calculated for all of the organic substances. The correlations were calculated using the Microsoft Excel data analysis tool. (See the table below for the correlation values for all organic substances (correlation ranges from zero to one, zero being no correlation and one perfect correlation.)

Substance	TOC Correlation	Particle Size Correlation
Anthracene	0.086156	0.106836
Benz(a)anthracene	0.1786	0.102538

Benzo(b)fluoranthene	0.254241	0.147598
Benzo(k)fluoranthene	0.225136	0.114189
Bis(2-ethylhexyl)phthalate	0.32715	0.018585
Chrysene	0.225886	0.128353
Dibenz(a,h)anthracene	0.15856	0.040402
Fluoranthene	0.112265	0.053681
Fluorene	0.032798	0.045616
Indeno(1,2,3-cd)pyrene	0.213186	0.088393
Phenanthrene	0.059423	0.031495
Pyrene	0.13597	0.053381
Benzo(a)pyrene	0.210306	0.115151
PCBs	0.0441	0.165645

## Organic SI Data

Sample	Type	Highest Release	% fines	% TOC	PCB	Q	anthracene	Q	Benz(a) anthracene	Q	Benzo(b) fluoranthene	Q	Benzo(k) fluoranthene	Q	Bis (2-ethylhexyl) Phthalate	Q
3X's BG					579		270		1110		1200		1260		1590	
DR001	release		70.43	3.01	99		120		470		580		450		650	
DR002	release		85.76	2.31	186	J	130		490		490		490		880	
DR003			78.23	2.12	267	J	120		370		540		410		970	
DR004			87.84	2.56	168	J	90		290		380		290		880	
DR005	release	I	78.13	2.3	168	J	130		470		720		500		1700	
DR006	release	I	72.29	2.72	315	J	130		500		790		530		2700	
DR007		*	59.81	3.48	173	J	180		720		910		810		3300	
DR008	release	I	62.57	4.47	428	J	220		1100		1300		1100		11000	
DR009	release	I	67.72	5.55	398	J	200	UI	970		1100		900		11000	
DR010	release		25.49	1.4	74		90		250		340		300		760	
DR011	release	I	78.46	2.49	1537	J	120		370		480		300		1200	
DR012			84.48	2.31	85	J	130		480		610		370		1000	
DR013			85.76	2.16	87	J	100		350		440		330		690	
DR014			77.45	2.45	77	J	130		400		530		420		570	
DR015	release	I	92.37	2.62	83	J	220		690		750		590		610	
DR016	release	I	87.57	2.79	118	J	320		810		720		580		700	
DR017		*	91.83	2.74	121	J	1800		1400		1500		840		820	
DR018			93.67	2.21	265	J	110		340		440		320		410	
DR019		*	92.08	2.61	162		860		1700		1600		1100		710	
DR020		*	78.14	2.72	169	J	370		1100		1900		1000		550	
DR021	release	I	86.26	3.1	142	J	220		650		720		510		710	
DR022	release	I	41.22	1.59	86	J	250		780		620		450		660	J
DR023			88.69	2.51	67	J	130		410		460		370		630	
DR024			89.01	2.51	180		110		350		360		280		450	
DR025			81.69	2.83	210		200		470		480		340		490	
DR026			74.95	3.24	279		110		370		370		300		460	
DR027			89.01	2.49	290		140		350		360		320		530	
DR028	release		74.81	2.43	207		180		530		430		380		390	
DR030	release	I	73.19	2.78	4793		90		240		340		430		1500	
DR031	release	I	35	2.07	342	J	350		620		580		460		590	
DR032	release		57.4	1.79	140	J	120		340		360		300		350	
DR033		*	57.12	1.72	225	J	1500		1900		1600		1100		610	
DR034			60.79	1.84	347	J	120		390		510		380		480	
DR035	release		72.03	2.29	516	J	110		490		770		610		720	
DR036	release		7.88	3.37	66	J	20		90		90		80		280	UJ
DR037		*	86.09	2.02	83	J	1200		850		580		440		400	
DR038	release	I	77.9	2.62	336	J	1600		2000		1400		980		570	
DR039			87.15	2.43	175		90		330		380		290		350	UJ
DR040		*	70.1	4.69	776		410		1300		1300		780		300	UJ
DR041	release		88.52	2.43	222	J	130		370		460		340		410	
DR042	release		67.02	9.23	182		50		200		340		300		310	UJ
DR043	release		56.88	4.48	270		30		110		190		150		190	UJ
DR044	release	I	56.31	2.08	131		420		2000		2000		1300		310	UJ
DR045			43.81	2.92	107		20	U	70		110		110		170	UJ
DR046	release		66.71	2.26	80		40		160		220		240		200	UJ
DR047	release	I	48.18	1.4	158		510		1300		850		740		230	UJ
DR048	release		82.64	2.03	88		260		840		510		400		310	UJ
DR049			85.76	2.64	120		230		490		520		390		420	
DR050	release	I	85.65	4.12	240	J	910		1600		1100		750		510	
DR051			35	2.77	50	U	150		360		420		290		440	
DR052			72.03	2.56	138		110		340		370		280		370	UJ
DR053		*	83.72	2.8	257	J	600		1800	J	1600	J	910	J	3800	J
DR054			70.1	2.36	97		110		330		360		300		450	
DR055	release		89.58	5.88	214		110		410		510		370		790	
DR056			90.34	1.89	60		50		190		230		210		410	
DR057	release		62.41	1.79	139		40		450		580		450		570	
DR058	release	I	30.63	0.9	1144	J	20	U	140		190		150		470	
DR059	release	I	91.98	2.73	210	J	60		490		470		660		2500	
DR060			79.72	1.93	102	J	30		240		300		240		400	UJ
DR061	release		82.01	2.65	145	J	70		480		700		410		880	
DR062	release	I	74.66	2.18	110	J	3620		620		570		400		570	
DR063			88.09	2.62	302		90		300		370		230		510	
DR064			84.09	2.58	227		120		320		390		260		470	
DR065	release	I	81.56	2.41	185		1900		930		530		440		410	
DR066			85.76	2.25	77	J	140		410		440		340		460	UJ
DR067	release	I	25.46	0.82	40	U	290		280		220		190		270	UJ



## Organic SI Data

Sample	Type	Highest Release	% fines	% TOC	PCB	Q	anthracene	Q	Benz(a) anthracene	Q	Benzo(b) fluoranthene	Q	Benzo(k) fluoranthene	Q	Bis (2-ethylhexyl) Phthalate	Q
DR068			89.39	2.36	93	J	150		380		480		320		490	
DR069			86.91	1.92	119		100		310		340		280		400	
DR070	release		67.97	1.75	136		60		220		330		270		380	UJ
DR071			83.77	2.16	68	J	60		190		240		200		360	
DR072			84.84	2.19	114		60		210		290		220		520	
DR073			78.23	2.49	154		110		310		350		300		370	UJ
DR074			57.12	2.46	127		90		280		350		280		480	
DR075			60.79	2.31	118		90		290		380		270		530	
DR076	release	1	0.01	0.1	40	U	20	U	20	U	20	U	20	U	6100	
DR077	release		69.42	1.61	120	J	100		390		580		490		520	
DR078			91.13	2.07	121	J	90		280		400		350		480	
DR079			93.5	2.18	187	J	90		340		420		360		1100	
DR080			82.57	1.82	175	J	60		210		290		240		400	
DR081	release	1	58.4	1.78	1473	J	40		110		170		130		1500	
DR082	release		79.1	1.97	430	J	90		360		620		420		1200	
DR083	release		84.74	2.29	567	J	100		390		540		440		1100	
DR084	release		50.9	1.23	326	J	60		220		290		240		600	
DR085			61.2	1.29	413	J	50		200		280		240		340	
DR086	release	1	85.89	1.97	116	J	160		380		250		210		240	
DR087	release	1	57.4	1.67	696		270		760		840		700		570	
DR088	release	1	74.99	1.68	1010	J	40		120		180		140		410	
DR089			7.88	1.92	271		70		280		400		300		930	
DR090			87.15	2.13	66		70		190		200		190		320	
DR091	release	1	21.93	0.86	45		130		300		260		210		110	
DR092	release		22.1	0.7	64		50		130		130		130		110	
DR093		*	79.15	2.55	223		110		340		400		330		520	
DR094	release		37.39	1.02	393	J	50		160		240		200		360	UJ
DR095			84.57	2.17	91	J	60		200		300		240		340	UJ
DR096			72.64	1.95	172	J	70		300		350		230		330	
DR097	release	1	86.78	2.99	126	J	1500		1100		1000		730		1200	
DR098			84.71	1.84	69	J	40		160		240		170		420	
DR099	release		21.06	1.66	32		70		40		160		100		330	UJ
DR100	release		20.52	0.61	40	U	120		200		230		200		160	UJ
DR101			82.83	1.73	40	U	220	J	340	J	280	J	270	J	120	UJ
DR102			59.97	2.15	108	J	70		350		460		330		400	
DR103			77.71	2.84	242	J	90		280		370		290		550	
DR104			75.08	2.82	177	J	120		350		470		310		620	
DR105			63.93	2.07	124	J	40		190		270		220		370	
DR106			89.04	2.43	227		190		350		410		350		460	
DR107			88.5	2.5	296		180		450		590		380		420	
DR108			88.66	2.33	258		100		380		550		360		400	
DR109			90.54	2.35	277	J	80		340		460		330		410	
DR110		*	82.84	2.67	284		140		460		600		390		520	
DR111	release		74.26	2.26	311		80		480	J	620	J	450	J	410	
DR112	release	1	79.41	2.64	243		320		1100		1300		800		440	
DR113			104.99	2.72	2027	J	30		50		120		100		910	
DR114		*	71.47	2.51	189	J	400		350		330		320		330	
DR115	release		46.35	1.3	142		100		380		410		380		240	UJ
DR116			83.91	2.53	157	J	100		330		350		300		390	
DR117		*	83.74	2.6	204	J	290		400		290		270		310	
DR118			82.58	2.8	53	J	110		350		320		280		350	
DR119			85.68	2.69	390	J	60		220		270		240		520	
DR120	release	1	56.88	2.78	188		480		2400		2000		890		440	
DR121			95.03	2.39	98		70		250		320		220		340	
DR122			90.07	2.18	123		90		350		460		390		560	
DR123	release	1	74.84	2.42	900		120		460		560		480		560	
DR124	release		24.17	2.78	161		120		480		1000		740		940	
DR125		*	89.94	2.85	151		180		550		510		380		280	
DR126	release		84.27	3.09	181		180		490		600		370		590	
DR127			82.83	2.78	179		130		410		480		300		550	
DR128			67.97	2.99	167		90		300		410		310		660	
DR129			84.8	2.67	217		120		290		350		330		550	
DR130			82.64	2.87	157		90		260		320		240		510	
DR131	release	1	20.73	1.47	97	J	110		380		350		300		1500	
DR132	release	1	77.46	2.9	129	J	440		600		540		430		520	UJ
DR133			26.87	0.76	79		40		120		110		100		180	
DR134			80.36	2.52	108	J	70		230		270		220		510	UJ

## Organic SI Data

Sample	Type	Highest Release	% fines	% TOC	PCB	Q	anthracene	Q	Benz(a) anthracene	Q	Benzo(b) fluoranthene	Q	Benzo(k) fluoranthene	Q	Bis (2-ethylhexyl) Phthalate	Q
DR135	release		48.02	2.04	260	J	30		70		80		30		110	UJ
DR136		*	69.21	2.55	79	J	360		1600		1700		1100		310	UJ
DR137			47.1	2.2	181	J	80		220		250		190		230	UJ
DR138			13.39	0.47	187		20	U	20	U	20		20	U	30	
DR139	release	1	65.96	2.96	2840		140		310		510		290		2500	
DR140			2.06	0.09	40	U	20	U	20	U	20	U	20	U	20	UJ
DR141			49.12	2.27	68	J	830	J	1300	J	960	J	780	J	260	UJ
DR142	release	1	6.03	0.35	40	U	340		610		480		530		50	UJ
DR143	release		16.12	0.82	25		120		300		260		330		60	
DR144		*	70.29	1.84	308		90		310		320		290		610	
DR145			85.22	2.46	204		60		180		220		200		390	
DR146			86.78	2.63	125	J	80		250		350		240		530	
DR147			84.99	2.71	345		100		410		450		320		770	
DR148			61.62	4.51	279	J	30		60		70		60		100	
DR149	release	1	67.38	2.01	95	J	220		600		480		430		290	U
DR150			80.54	2.18	137	J	50		180		200		170		390	
DR151			83.2	2.68	325	J	120		320		350		320		540	
DR152			90.8	2.37	124		70		220		290		260		450	
DR153			88.47	2.19	113		120		320		390		310		510	
DR154			81.09	2.33	101	J	40		170		210		170		390	UJ
DR155	release	1	80.21	2.7	106	J	180		350		380		260		2500	
DR156			79.95	2.75	92	J	50		190		230		160		430	UJ
DR157	release	1	47.51	5.47	4707		160		440		480		360		23000	
DR158			40.09	1.26	75	J	70		260		300		240		230	UJ
DR159			73.58	2.76	118	J	100		310		330		240		440	UJ
DR160	release	1	67.02	2.41	115		260		550		400		390		1900	
DR161			88.58	2.87	24		20	U	40		50		40		90	
DR162			70.29	1.9	146		30		150		170		180		250	
DR163			90.11	2.3	72		20	U	120		130		140		300	
DR164			84.54	2.58	64	J	40		120		160		120		280	U
DR165			76.65	2.36	57	J	20		80		100		80		190	UJ
DR166			56.96	1.47	95	J	20	U	80		90		80		240	UJ
DR167	release		40.73	1.53	139	J	20	U	80		110		90		170	UJ
DR168			63.34	3.1	120	J	20	U	210		230		210		280	UJ
DR169		*	64.14	2.01	65	J	20	U	100		120		90		160	UJ
DR170			76.55	2.04	51	J	20	U	90		110		90		180	UJ
DR171			80.5	2.47	103	J	180		260		310		200		390	
DR172			3.79	0.24	40	U	20	U	50		70		50		20	
DR173	release		24.66	0.87	62	J	20		160		190		170		100	
DR174	release	1	50.58	1.59	494		120		1500		1500		1000		300	
DR175	release	1	64.35	1.74	120		1700		3000		2000		1300		270	
DR176	release	1	76.2	2.62	219		500		880		600		510		450	
DR177	release	1	85.85	2.87	632	J	130		420		610		530		700	
DR178	release	1	78.69	3.44	7044	J	540		2600	J	4700	J	3300	J	5100	
DR179	release	1	77.82	2.83	3358	J	210		1200		2400		1700		2800	
DR180	release	1	69.37	2.63	527	J	70		230		350		270		500	
DR181			76.19	2.34	1672	J	80		280		410		320		790	
DR182			52.54	4.54	318	J	70		180		240		200		340	
DR183			68.66	1.8	122	J	20	U	50		70		60		50	
DR184			90.86	2.21	139	J	40		200		240		250		430	
DR185	release		86.56	1.96	75		80		450		470		440		310	
DR186	release	1	66.31	2.01	1178		330		930		840		700		210	
DR187	release	1	32.13	1.9	246		800		4800		3300		4000		1500	
DR188			80.98	1.75	104		20		120		150		170		260	
DR189	release	1	41.05	1.38	93		510		860		1100		840		440	
DR190			63.41	1.9	56	J	190		1100		870		600		240	UJ
DR191	release		84.91	2.19	77		160		920		570		460		460	
DR192			58.36	2.63	112		50		260		200		170		110	
DR193			40.41	1.21	118		50		140		140		130		130	
DR194			86.9	3.06	155		80		280		330		250		610	
DR195			48.7	1.37	64	J	20	U	90		120		100		130	UJ
DR196			41.47	1.17	115		20		90		130		110		150	UJ
DR197			44.85	1.3	98		20	U	50		80		70		110	UJ
DR198			38.67	1.54	85		20	U	70		120		100		150	UJ
DR199			54.14	1.45	69		20		80		110		90		130	UJ
DR200			55.69	1.73	83		20	U	80		130		100		150	UJ
DR201	release	1	53.27	1.7	655		30		50		80		70		150	

## Organic SI Data

Sample	Type	Highest Release	% fines	% TOC	PCB	Q	anthracene	Q	Benz(a) anthracene	Q	Benzo(b) fluoranthene	Q	Benzo(k) fluoranthene	Q	Bis (2-ethylhexyl) Phthalate	Q
DR202			44.53	1.57	98		20	U	90		80		100		80	
DR203			42.84	1.06	101		20	U	60		80		80		130	
DR204			43.18	1.09	40		20	U	100		130		120		180	
DR205			83.54	2.22	35		20	U	50		60		70		150	
DR206			91.81	2.97	205		20	U	80		130		90		280	
DR207	release	I	28.22	3.17	12000		140		920		1700		1200		120	
DR208	release		45.34	1.29	388		20	UJ	50	J	50	J	60	J	50	J
DR209	release		12.88	1.03	67		20	U	30		40		50		160	
DR210	release		60.47	1.45	375		20	U	100		150		150		200	
DR211			72.91	1.56	56		20	U	50		70		70		160	
DR212			44.76	1.5	77	J	50		130		100		90		40	UJ
DR213			51.33	1.25	136	J	80		350		340		310		170	UJ
DR214			56.83	1.53	111	J	40		150		150		150		300	
DR215			80.16	2.16	107	J	50		180		240		19		460	
DR216			86.15	2.13	313		60		220		300		230		660	
DR217	release	I	54.97	1.67	4200	J	80		470		730		450		1000	
DR218			89.54	2.56	87	J	30		140		170		170		430	
DR219	release		87.85	2.22	186		100		380		490		450		710	
DR220			86.31	2.76	77		20		110		170		160		400	
DR221	release	I	73.58	1.57	64	J	140		1000		510		490		230	UJ
DR222			36.31	0.95	132		20	U	80		80		70		130	
DR223			80.04	2.09	153		40		160		200		150		350	
DR224			46.6	1.17	57		20	U	60		80		70		260	
DR225			71.33	1.73	145		30		140		220		170		270	
DR226			45.77	1.77	113		20	U	90		110		120		180	
DR227			80.77	2	25		20	U	60		80		80		140	
DR228			84.16	2.48	161	J	40		160		180		160		410	
DR229			67.65	2.04	22		20	U	70		90		90		200	
DR230			85.68	2.4	86		20		100		150		130		360	
DR231			74.88	2.17	102	J	50		160		170		170		300	UJ
DR232	release	I	43.61	1.37	81		60		220		160		150		180	
DR233			75.28	2.19	149	J	30		130		190		150		280	U
DR234			54.74	1.77	54	J	20		90		130		110		240	U
DR235			79.09	1.92	75		20	U	80		110		110		240	
DR236			33.51	0.85	129		20	U	80		90		100		100	
DR237			47.21	1.46	98		20	U	50		70		80		100	
DR238			85.47	1.78	40	U	20	U	90		140		140		130	
DR239	release	I	64.18	1.69	22		60		180		270		230		100	
DR240			96.5	3.6	95	J	30		140		270		260		470	
DR241			96.63	3.56	77	J	40		250		430		380		430	
DR242			100.73	3.5	93	J	110		620		930	J	740	J	620	
DR243			96.71	3.66	118	J	60		280		420		360		380	
DR244			97.01	3.52	133	J	20		160		240		210		360	
DR245			94.84	3.43	105	J	20	U	160		250		200		360	
DR246			93.92	3.63	20		20	U	120		190		150		400	
DR247			88.33	1.99	63		20	U	70		110		90		260	UJ
DR248			83.68	2.28	72		20	U	100		150		140		330	UJ
DR249			71.2	1.48	40	U	20	U	40		50		60		140	UJ
DR251			67.36	1.88	71		20	U	60		90		80		210	UJ
DR252			33.9	1.67	40	U	20	U	60		90		90		160	
DR253			56.43	1.56	53		60		180		210		220		280	
DR254			1.32	1.9	40	U	20	U	20	U	20	U	20	U	20	U
DR255			69.08	1.81	45		190		130		190		180		390	
DR256			65.37	2.06	42		220		170		220		240		570	
DR257			0.01	0.15	40	U	20	U	20	U	20	U	20	U	20	U
DR258			52.77	1.55	62		130		120		130		110		390	
DR259			84.1	2.94	123		180		130		180		170		610	
DR260			89.2	3.09	80		20	U	80		100		90		330	
DR261			74.84	2.48	83		20	U	100		150		140		320	
DR262			69.77	2.46	52	J	20	U	110		140		110		260	
DR263			80.58	2.9	50	J	20	U	80		130		120		280	
DR264			55.4	1.48	51		20	U	70		70		70		150	UJ
DR265			34.96	1.03	40	U	30		70		60		90		80	UJ

## Organic SI Data

Sample	Type	Highest Release	% fines	% TOC	PCB	Q	anthracene	Q	Benz(a) anthracene	Q	Benzo(b) fluoranthene	Q	Benzo(k) fluoranthene	Q	Bis (2-ethylhexyl) Phthalate	Q
DR266			54.45	1.38	51		20	U	50		70		90		160	UJ
DR267	release		34.69	0.85	21		20	U	50		70		70		120	UJ
DR269			28.81	0.9	40	U	20	U	60		90		80		120	UJ
DR270			34.44	1.32	40	U	20	U	50		60		70		120	
DR271	release	1	36.42	2.61	9400		20	U	220		330		300		260	
DR276	release	1	32.83	1.51	32		140		410		360		340		340	
DR277			89.18	1.86	91		20		110		160		140		280	
DR278			90.48	3.27	80		20		130		170		150		350	
DR279			79.24	1.82	53		20	U	60		80		90		160	
DR280			83.53	2.53	72		20	U	100		160		150		410	
DR282			83.58	2.58	87		20	U	100		150		120		410	
DR283			77.44	2.47	68		30		130		190		190		520	
DR284			67.03	2.23	61		20		100		150		140		340	
DR285			83.62	3.39	53	J	20		130		160		160		450	
DR286			58.19	1.42	54		20	U	50		80		100		150	UJ
DR287			55.84	1.31	25		20	U	60		90		100		190	UJ
DR288			85.64	2.97	83		20	U	60		100		110		130	
DR289			80.69	3.63	58		20		90		150		150		450	
DR291			58.79	3.79	127		30		140		210		190		490	
DR292			75.47	5.29	254		40		200		280		250		530	
DR294			3.29	0.15	40	U	20	U	20	U	20	U	20		50	
DR295			0.01	0.15	40	U	20	U	20	U	20	U	20	U	20	
DR296			0.01	0.65	40	U	20	U	20	U	20	U	20	U	20	U

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## BACKGROUND

DR250	BG		76.68	1.89	40	U	20	U	40		50		50		110	UJ
DR268	BG		54.86	2.1	34		50		200		180		210		150	UJ
DR272	BG		55.9	0.11	52		20	U	80		110		120		80	
DR273	BG		43.47	1.66	45		20		130		170		180		120	
DR274	BG		31.76	1.39	40	U	90		370		400		420		150	
DR275	BG		37.56	1.06	40	U	20		100		110		130		110	
DR281	BG		78.63	3.64	193		20		140		180		190		530	
DR290	BG		77.59	4.01	170		30		130		220		180		500	
DR293	BG		43.74	1.74	40	U	30		140		190		180		330	UJ
DR297	BG		0.01	0.14	40	U	20	U	20	U	20	U	20	U	20	U
DR298	BG		0.01	0.08	40	U	20	U	20	U	20	U	20	U	20	U
DR299	BG		0.01	0.14	40	U	20	U	20	U	20	U	20	U	20	U
DR300	BG		0.01	0.11	40	U	20	U	20	U	20	U	20	U	20	U
DR301	BG		0.01	0.08	40	U	20	U	20	U	20	U	20	U	20	U

## Organic SI Data

Sample	Chrysene	Q	Dibenz(a,h) anthracene	Q	Fluoranthene	Q	Fluorene	Q	Indeno (1,2,3-cd) pyrene	Q	Phenanthrene	Q	Pyrene	Q	Benzo(a) pyrene	Q
3X's BG	1470		210		5100		90		960		1650		4800		1320	
DR001	730		60		1200		40		220		370		1100		410	
DR002	660		80		990		40		270		290		760		420	
DR003	560		60		460		30		240		250		760		410	
DR004	430		50		560		40		210		220		550		300	
DR005	650		70		930		40		320		360		950		520	
DR006	680		70		930		50		360		460		1200		560	
DR007	900		110		1400		80		500		890		1600		760	
DR008	1700		230		3300		200	U	1000		1400		2700		1100	
DR009	1400		220		2900		20	U	880		1400		2200		980	
DR010	440		40		970		30		180		420		880		250	
DR011	540		50		1100		50		280		340		770		370	
DR012	700		50		900		40		350		310		830		490	
DR013	500		50		780		40		250		290		650		360	
DR014	610		80		1200		60		350		480		910		470	
DR015	1000		90		2500		90		360		800		1400		570	
DR016	1200		80		2200		70		340		440		1300		570	
DR017	1800		190		3300		310		610		1200		2200		1000	
DR018	500		50		730		40		240		210		610		340	
DR019	2000		270		4000		610		920		3000		3200		1400	
DR020	1800		240		2700		110		770		870		2300		1300	
DR021	970		90		1400		80		370		440		1200		560	
DR022	880		60		2100		110		250		580		1900		450	
DR023	510		70		1000		40		260		260		820		370	
DR024	460		50		870		30		190		220		640		280	
DR025	610		50		1200		50		230		370		910		360	
DR026	480		50		810		40		220		290		750		320	
DR027	540		50		850		60		220		350		640		320	
DR028	680		60		1100		70		230		640		1100		410	
DR030	410		20	U	680		50		150		390		1200		280	
DR031	790		80		1200		80		340		630		1200		550	
DR032	450		50		810		30		180		200		690		310	
DR033	2400		190		6400		570		770		2600		3300		1300	
DR034	580		60		600		40		270		270		780		420	
DR035	910		100		2200		50		410		1100		1800		560	
DR036	130		20		180		20	U	70		130		280		90	
DR037	990		60		3600		880		270		3500		2200		460	
DR038	2200		130		7800		580		560		3600		4600		1100	
DR039	540		50		680		30		180		240		540		280	
DR040	2100		160		2900		200		480		910		2100		800	
DR041	550		60		840		40		230		270		630		360	
DR042	360		50		570		20	U	200		220		580		250	
DR043	220		20	U	310		20	U	100		130		350		140	
DR044	4600		150		23000		90		520		3000		16000		890	
DR045	130		20		170		20	U	80		60		170		90	
DR046	310		50		480		20	U	140		160		520		190	
DR047	1500		90		2500		40		330		230		3500		730	
DR048	1100		70		250		50		210		290		1200		380	
DR049	710		70		1800		80		230		570		970		380	
DR050	2100		120		6700		330		420		1400		4200		820	
DR051	500		50		1200		90		210		580		730		290	
DR052	470		60		990		40		190		210		630		270	
DR053	2100	J	150	J	5500		650	J	620	J	2800	J	3400		1100	J
DR054	490		50		890		40		210		240		690		290	
DR055	590		70		750		30		240		230		730		370	
DR056	280		40		360		20	U	140		120		320		190	
DR057	680		90		780		40		350		300		740		490	
DR058	220		30		220		20	U	130		130		330		160	
DR059	660		70		970		60		270		790		1200		480	
DR060	380		50		500		30		240		230		410		260	
DR061	710		70		1200		70		410		370		890		490	
DR062	730		70		1700		70		260		390		1300		440	
DR063	450		50		710		40		160		240		580		260	
DR064	470		50		910		60		210		380		690		300	
DR065	980		60		4200		2100		220		8900		2900		450	
DR066	570		60		810		40		240		260		600		360	
DR067	400		20	U	760		120		120		510		470		190	

## Organic SI Data

Sample	Chrysene	Q	Dibenz(a,h) anthracene	Q	Fluoranthene	Q	Fluorene	Q	Indeno (1,2,3-cd) pyrene	Q	Phenanthrene	Q	Pyrene	Q	Benzo(a) pyrene	Q
DR068	560		60		970		50		270		270		620		380	
DR069	420		50		700		30		190		230		530		290	
DR070	330		40		420		20	U	190		170		440		270	
DR071	290		40		400		20		170		150		300		210	
DR072	290		40		430		20		180		220		510		250	
DR073	480		50		880		40		200		250		590		280	
DR074	410		70		630		30		210		210		490		270	
DR075	400		50		660		40		220		300		570		260	
DR076	30		20	U	20	U	20	U	20	U	20	U	20	U	20	U
DR077	570		50		620		30		200		230		920		410	
DR078	460		40		550		30		150		170		610		300	
DR079	480		40		630		20		160		200		670		310	
DR080	330		20		600		20		120		180		510		220	
DR081	150		30		200		30		110		140		520		160	
DR082	500		80		620		40		340		330		1000		480	
DR083	540		80		710		40		310		380		1200		490	
DR084	290		50		400		20		190		200		580		270	
DR085	230		50		370		20		180		200		610		280	
DR086	400		30		1300		260		120		1500		880		210	
DR087	800		210		1800		180		620		1200		1300		840	
DR088	160		30		230		20		120		140		430		160	
DR089	400		60		690		30		250		300		910		380	
DR090	280		30		440		30		110		150		360		180	
DR091	380		40		1100		90		120		560		820		190	
DR092	180		20	U	400		50		60		230		360		110	
DR093	490		50		820		90		200		430		770		330	
DR094	280		20		430		40		100		150		410		180	
DR095	300		40		590		20		150		130		430		220	
DR096	400		60		640		30		170		150		530		240	
DR097	1700		70		2700		360		350		1400		1900		670	
DR098	230		20	U	410		20	U	100		110		360		160	
DR099	180		20	U	280		30		60		110		230		110	
DR100	360		30		360		30		130		110		310		170	
DR101	430	J	40	J	690	J	100	J	170	J	750	J	770	J	330	J
DR102	470		50		890		30		240		210		660		320	
DR103	420		50		700		30		240		210		540		300	
DR104	530		70		870		50		260		260		680		340	
DR105	290		40		400		20	U	200		140		370		240	
DR106	520		70		860		50		240		250		580		340	
DR107	590		70		1300		50		300		280		880		440	
DR108	460		70		940		30		280		210		670		410	
DR109	460		70		650		30		250		190		610		340	
DR110	570		50		1300		90		290		500		960		450	
DR111	450		50		880	J	40		300	J	250		890	J	460	J
DR112	1500		110		5300		90		470		800		2800		790	
DR113	90		20	U	100		20	U	70		60		420		100	
DR114	430		50		800		90		190		300		680		280	
DR115	610		50		1000		30		210		240		760		360	
DR116	470		40		740		40		170		240		700		270	
DR117	460		30		1400		110		140		640		1100		250	
DR118	470		40		960		70		160		370		810		260	
DR119	320		30		540		30		170		220		500		220	
DR120	3300		160		14000		190		470		3900		4900		620	
DR121	360		40		600		30		170		170		460		230	
DR122	550		70		750		40		290		240		700		360	
DR123	730		100		820		50		400		420		940		530	
DR124	790		140		1100		40		680		430		1000		770	
DR125	910		60		1500		110		230		590		930		380	
DR126	720		70		1300		80		290		460		880		420	
DR127	610		60		1000		60		240		310		730		330	
DR128	500		50		710		60		210		280		630		290	
DR129	470		20	U	740		70		160		310		740		290	
DR130	440		40		990		70		160		500		800		220	
DR131	460		70		920		90		210		640		800		340	
DR132	830		60		2600		310		270		2400		1900		410	
DR133	170		20	U	370		20	U	70		90		300		90	
DR134	330		40		690		80		160		190		530		210	

## Organic SI Data

Sample	Chrysene	Q	Dibenz(a,h) anthracene	Q	Fluoranthene	Q	Fluorene	Q	Indeno (1,2,3-cd) pyrene	Q	Phenanthrene	Q	Pyrene	Q	Benzo(a) pyrene	Q
DR135	90		20	U	230		40		30		150		170		40	
DR136	1800		190		190		150		940		1600		3200		1300	
DR137	350		30		30		30		120		190		560		200	
DR138	30		20	U	20	U	20	U	20	U	20	U	30		20	U
DR139	480		80		80		140		2200		360		870		310	
DR140	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
DR141	1300	J	140		3600	J	570	J	580	J	2900	J	2200	J	940	J
DR142	620		90		2200		370		410		2100		1300		590	
DR143	400		60		660		50		230		480		580		310	
DR144	410		50		800		100		160		400		970		300	
DR145	260		30		440		40		120		190		450		180	
DR146	360		40		660		30		190		170		460		250	
DR147	530		60		1000		40		220		300		770		300	
DR148	90		20	U	140		30		50		80		130		60	
DR149	740		50		2200		110		240		820		1500		390	
DR150	250		30		490		20	U	130		140		380		160	
DR151	440		40		740		40		210		310		720		300	
DR152	350		30		530		30		140		180		540		220	
DR153	500		60		850		60		220		270		580		290	
DR154	230		30		430		20	U	110		120		360		150	
DR155	520		50		1000		50		160		320		730		270	
DR156	260		30		510		30		120		140		390		180	
DR157	680		20	U	680		50		180		320		1400		320	
DR158	290		40		640		30		180		260		470		260	
DR159	390		40		960		50		180		390		750		250	
DR160	650		60		1600		170		260		1200		1000		350	
DR161	60		20	U	100		20	U	40		40		90		40	
DR162	220		20		350		30		90		150		380		150	
DR163	170		20	U	320		20	U	70		90		290		120	
DR164	170		20	U	340		20		110		100		230		120	
DR165	110		20	U	220		20	U	70		90		190		90	
DR166	100		20	U	230		20	U	60		60		190		80	
DR167	140		20	U	110		20	U	60		70		130		90	
DR168	340		30		510		30		130		180		410		180	
DR169	140		260		260		20	U	60		90		230		90	
DR170	120		20	U	230		20	U	60		70		210		80	
DR171	330		40		1100		70		170		470		640		220	
DR172	90		20	U	130		20	U	30		30		80		50	
DR173	250		30		390		20		100		160		310		170	
DR174	1800		130		2800		1200		480		700		2600		1100	
DR175	3400		150		18000		1700		660		16000		11000		1200	
DR176	1100		80		3900		1000		290		3900		2500		490	
DR177	600		40		1100		70		20		480		1100		420	
DR178	3500		680	J	7500		190		2300	J	2400		7500		3500	J
DR179	1700		250		3700		70		1100		1100		3700		1700	
DR180	320		30		620		50		120		210		620		190	
DR181	410		70		690		40		270		270		810		340	
DR182	230		30		400		20		50		150		230		50	
DR183	50		20	U	100		20	U	20	U	70		70		20	U
DR184	290		30		640		20		190		240		450		230	
DR185	780		60		1400		20		260		300		1200		360	
DR186	1100		120		2300		300		510		1700		2200		830	
DR187	4100		950		8800		530		2900		6300		10000		3700	
DR188	180		30		340		20	U	110		140		290		140	
DR189	1600		100		6900		170		410		2500		3500		610	
DR190	1300		80		2100		80		290		570		2100		670	
DR191	870		50		2800		80		220		760		1900		440	
DR192	290		20	U	720		30		80		180		700		160	
DR193	190		20		260		20	U	90		130		280		130	
DR194	340		30		840		60		150		280		540		240	
DR195	140		20		210		20	U	100		90		170		110	
DR196	150		20		220		20	U	100		110		220		120	
DR197	90		20	U	130		20	U	70		50		120		60	
DR198	130		20		190		20	U	90		70		160		100	
DR199	130		20	U	230		20	U	90		90		200		100	
DR200	120		20	U	240		20	U	90		90		190		100	
DR201	100		20	U	140		20	U	50		60		130		60	

## Organic SI Data

Sample	Chrysene	Q	Dibenz(a,h) anthracene	Q	Fluoranthene	Q	Fluorene	Q	Indeno (1,2,3-cd) pyrene	Q	Phenanthrene	Q	Pyrene	Q	Benzo(a) pyrene	Q
DR202	110		20	U	230		20	U	60		70		190		90	
DR203	110		20	U	150		20	U	50		60		140		60	
DR204	160		50		230		20	U	120		80		190		120	
DR205	100		20	U	130		20	U	50		60		110		50	
DR206	120		20		280		20	U	80		80		220		80	
DR207	1800		150		4500		150		510		2100		4200		1000	
DR208	80	J	20	UJ	110	J	20	UJ	40	J	70	J	130	J	60	J
DR209	60		20	U	100		20	U	40		50		90		40	
DR210	180		20		300		20	U	90		130		250		130	
DR211	80		20	U	130		20	U	50		50		120		60	
DR212	190		20	U	190		20	U	60		70		150		90	
DR213	420		50		700		20		210		200		590		320	
DR214	210		20	U	400		20	U	100		140		310		120	
DR215	270		40		510		20		170		180		390		180	
DR216	330		30		710		30		150		240		530		220	
DR217	600		90		470		20		280		200		980		440	
DR218	210		30		460		20	U	110		140		340		140	
DR219	560		80		1100		50		370		560		930		460	
DR220	180		20		340		20	U	100		110		270		130	
DR221	840		50		4200		90		190		790		2700		460	
DR222	100		20	U	220		20	U	50		90		240		70	
DR223	230		30		420		20		130		140		330		150	
DR224	90		20	U	150		20	U	60		50		130		70	
DR225	220		30		350		20	U	130		130		350		170	
DR226	140		20	U	230		20	U	60		90		230		90	
DR227	90		20	U	150		20	U	50		50		150		50	
DR228	230		20		520		40		110		240		520		140	
DR229	110		20		180		20	U	70		70		180		80	
DR230	160		20	U	290		20	U	90		100		240		120	
DR231	230		30		500		20		110		130		370		150	
DR232	240		20	U	650		110		80		640		550		140	
DR233	200		30		370		20	U	130		120		290		150	
DR234	130		20		240		20	U	100		90		220		110	
DR235	130		20	U	200		20	U	70		80		220		90	
DR236	140		20	U	190		20	U	70		100		220		90	
DR237	90		20	U	160		20	U	40		70		140		60	
DR238	180		20		270		20	U	70		100		260		110	
DR239	480		20		1500		90		80		1200		1100		150	
DR240	250		30		440		20	U	110		170		460		190	
DR241	410		40		810		20	U	220		330		860		340	
DR242	920	J	100		2000		70		180		980		1100	J	170	
DR243	440		40		770		30		150		290		730		270	
DR244	260		40		450		20		190		190		420		200	
DR245	240		30		450		20	U	120		170		370		170	
DR246	200		30		370		20	U	150		130		260		150	
DR247	110		20	U	210		20	U	60		90		180		80	
DR248	160		20		280		20	U	100		120		260		120	
DR249	70		20	U	120		20	U	40		60		110		40	
DR251	100		20	U	170		20	U	60		70		150		70	
DR252	110		20	U	200		20	U	60		80		160		80	
DR253	310		30		620		20		160		290		530		200	
DR254	20	U	20	U	20	U	20	U	20	U	20	U	20	U	20	U
DR255	200		30		450		20	U	160		180		340		180	
DR256	270		40		570		20	U	180		240		440		210	
DR257	20	U	20	U	20		20	U	20	U	20	U	20	U	20	U
DR258	160		20	U	300		20	U	90		210		260		120	
DR259	180		20	U	360		20	U	80		130		320		130	
DR260	130		20	U	260		20	U	70		80		190		80	
DR261	150		20	U	310		20	U	80		100		290		120	
DR262	150		20	U	250		20	U	110		100		260		110	
DR263	160		20	U	390		20	U	80		160		300		90	
DR264	100		20	U	210		20	U	50		70		180		70	
DR265	100		20	U	290		20		40		110		260		60	



## Organic SI Data

Sample	Chrysene	Q	Dibenz(a,h) anthracene	Q	Fluoranthene	Q	Fluorene	Q	Indeno (1,2,3-cd) pyrene	Q	Phenanthrene	Q	Pyrene	Q	Benzo(a) pyrene	Q
DR266	90		20	U	170		20	U	50		70		150		70	
DR267	90		20	U	150		20	U	40		70		120		60	
DR269	110		20	U	150		20	U	50		60		160		70	
DR270	80		20	U	140		20	U	40		60		120		50	
DR271	290		50		420		20	U	240		90		360		300	
DR276	520		60		1500		280		230		1300		980		340	
DR277	170		20		310		20	U	100		120		250		130	
DR278	190		20		340		20	U	90		140		360		130	
DR279	90		20	U	180		20	U	60		80		180		70	
DR280	170		20		310		20	U	100		120		280		130	
DR282	170		20	U	300		20	U	80		100		230		110	
DR283	210		20	U	460		20	U	90		140		390		150	
DR284	170		20	U	380		20	U	90		190		300		120	
DR285	190		20	U	410		20		90		150		330		120	
DR286	90		20	U	160	J	20	U	60		70		150		70	
DR287	100		20	U	180		20	U	60		80		170		70	
DR288	110		20	U	220		20	U	60		90		190		80	
DR289	170		20		330		20	U	90		120		260		120	
DR291	220		20		380		20		100		180		410		140	
DR292	290		20		480		40		120		290		580		210	
DR294	30		20	U	60		20	U	20	U	30		40		20	
DR295	20	U	20	U	30		20	U	20	U	30		30		20	U
DR296	20	U	20	U	30		20	U	20	U	30		20	U	20	U

## BACKG

[illegible]

**Attachment G**  
**SI, NOAA, and Boeing Data Sets With Normalized Releases and Overall**  
**Highest Background Releases for PCBs**

This attachment documents that observed releases by chemical analysis could still be identified if the analytical data used to identify observed releases from the 1998 EPA SI data set (Reference 4 and 6 of the HRS documentation record at proposal), the NOAA data set (Reference 8 of the HRS documentation record at proposal) and the Boeing data set (Reference 7 of the HRS documentation record at proposal) if the data were normalized for PCBs and the highest normalized PCB concentration in any background sample for each data set was used as the background level.

Data was normalized by dividing PCB concentrations by the fraction of TOC and dividing this value by 1000 for PCB levels per mg/kg of organic carbon (for the SI and NOAA data sets, Boeing had already normalized their data and those values were used). For example for sample number DR011, in the 1998 SI data set the concentration of PCBs 1537  $\mu\text{g/kg}$  was divided by .0249 the fraction of TOC in that sample, this value was then divided by 1000 to convert the units to mg/kg, for a normalized value of PCBs of 61.73 mg/kg of organic carbon.

The highest normalized background concentration of PCBs for each data set was identified (this value was bolded and then multiplied by three per HRS Table 2-3 *Observed Release Criteria for Chemical Analysis* and then, also included in the second row across the top of each table called 3X s BG (i.e., for the 1998 SI data sample DR272 had the highest normalized concentration of PCBs at 47.28 mg/kg of organic carbon, three times this value is 141.84; therefore any sample with a normalized PCB concentration of 141.84 or greater, sample DR178 which has an normalized PCB concentration of 204.77 mg/kg of organic carbon would qualify as an observed release by chemical analysis.

The samples meet observed release criteria after being normalized and using the highest normalized background were noted by being bolded and a 1 in the column Normalized release

Then EPA used the highest background level of PCBs for each data set to see which sample still met the observed release criteria. In the SI data set sample 281 has the highest concentration of PCBs at 193  $\mu\text{g/kg}$ , this value is multiplied by three per HRS Table 2-3 *Observed Release Criteria for Chemical Analysis* for a value of 579, all samples with a concentration of PCBs greater than or equal to 579 meet the criteria for an observed release (i.e., sample DR011 with 1537  $\mu\text{g/kg}$  of PCBs). Again the concentrations that still meet the criteria for observed release using the highest background are bolded and a 1 is in the column Highest release

Information for the Normalized and Highest Background PCB SI Data was obtained from the HRS documentation record at proposal (pages 10-30) and references 4 and 6 (Ref. 4, pp. 848-898 and Ref. 6, pp. 3613-3711).

- The first column is the sample number.
- The second column *type* indicates if the sample was a release sample, a PCB release sample, or a background sample in the HRS documentation record at proposal.
- The third column *% fines* contains the percent of fines present in that sample.
- The forth column contains the percent TOC present in that sample.
- The fifth column contains total PCB concentrations for that sample in  $\mu\text{g/kg}$ .
- The sixth column *Q* contains any data qualifiers that may have been associated with the sample for PCB concentrations (percent TOC values for this data set did not have any qualifiers

associated with it).

- The seventh column *Normalized* contains the normalized PCB concentrations (calculated by dividing PCB concentrations by the fraction of TOC and dividing this value by 1000 for PCB levels per mg/kg of organic carbon).
- In the eighth column *Normalized release* if there is a 1 in this column it indicates that this sample was an observed release in the documentation record at proposal and still qualifies for an observed release when the data has been normalized (using sample DR 272, 47.27 mg/kg TOC as background).
- In the ninth column *Highest background release* if there is a 1 in this column it indicates that this was an observed release in the HRS documentation record at proposal and the sample still meets the requirements of an observed release if the highest background level of PCBs is used, an asterisk indicates that the sample qualifies for an observed release but was not included in the documentation record and therefore will not be used in any discussions in this support documents (using sample DR 281, 193T  $\mu\text{g/kg}$  as background). (Bolded values also represent observed release substances.)

Information for Table 2, Boeing Company Normalized PCB Release Data was obtained from the HRS documentation record at proposal (pages 31-35) and Reference 7, page 46 - Figure 6 for a map depicting total PCB mg/kg organic carbon for each sample location.

- The first column is the sample number.
- The second column contains the Total PCB concentration in  $\mu\text{g/kg}$ .
- The third column contains the normalized concentration of PCBs in mg/kg of TOC.
- The fourth column *Q* contains any qualifier that may be associated with the data.
- In the fifth column *Normalized releases*, a 1 indicates that the sample qualifies for an observed release if the data is normalized (using sample Ref 2 as the background with a detection limit of 4.4 mg/kg of TOC).
- The sixth column *Doc Rec PCB releases* has a 1 if the sample was used as an observed release sample in the HRS documentation record at proposal. The highest background level was used in the HRS documentation record at proposal. Bolded values also represent observed release substances.

Information for Table 3, NOAA PCB Normalized and Highest Background Release Data was obtained from the HRS documentation record at proposal (pages 35-39) and Reference 8 pages 38-47.

- The first column is the sample number.
- The second column contains the Total PCB concentration in  $\mu\text{g/kg}$ .
- The third column contains the fraction of TOC.
- The fourth column contains the normalized PCB concentrations calculated by dividing PCB

concentrations by the fraction of TOC and dividing this value by 1000 for PCB levels per mg/kg of organic carbon.

- In the fifth column **Normalized release**, a **1** indicates that the sample qualifies for an observed release if the data is normalized (using sample DAC-WIT01-04 as the background with 8.72 mg/kg of TOC).
- In the sixth column **Highest background release** if there is a **1** in this column it indicates that this sample meets the requirements of an observed release if the highest background level of PCBs is used (using sample DAC-WIT01-04, 96 µg/kg as background). Bolded values also represent observed release substances.

Normalized and Highest Background PCB SI Data

Sample	type	% fines	% TOC	PCB	Q	Normalized	Normalized release	Highest Release
<b>3X's BG</b>	<b>background</b>			<b>579</b>		<b>141.84</b>		
DR001	release	70.43	3.01	99		3.289036545		
DR002	release	85.76	2.31	186	J	8.051948052		
DR003		78.23	2.12	267	J	12.59433962		
DR004		87.84	2.56	168	J	6.5625		
DR005	release	78.13	2.3	168	J	7.304347826		
DR006	PCB	72.29	2.72	315	J	11.58088235		
DR007		59.81	3.48	173	J	4.971264368		
DR008	PCB	62.57	4.47	428	J	9.574944072		
DR009	PCB	67.72	5.55	398	J	7.171171171		
DR010	release	25.49	1.4	74		5.285714286		
DR011	PCB	78.46	2.49	1537	J	61.72690763		1
DR012		84.48	2.31	85	J	3.67965368		
DR013		85.76	2.16	87	J	4.027777778		
DR014		77.45	2.45	77	J	3.142857143		
DR015	release	92.37	2.62	83	J	3.167938931		
DR016	release	87.57	2.79	118	J	4.229390681		
DR017		91.83	2.74	121	J	4.416058394		
DR018		93.67	2.21	265	J	11.99095023		
DR019		92.08	2.61	162		6.206896552		
DR020		78.14	2.72	169	J	6.213235294		
DR021	release	86.26	3.1	142	J	4.580645161		
DR022	release	41.22	1.59	86	J	5.408805031		
DR023		88.69	2.51	67	J	2.669322709		
DR024		89.01	2.51	180		7.171314741		
DR025		81.69	2.83	210		7.4204947		
DR026		74.95	3.24	279		8.611111111		
DR027		89.01	2.49	290		11.64658635		
DR028	release	74.81	2.43	207		8.518518519		
DR030	PCB	73.19	2.78	4793		172.4100719		1
DR031	release	35	2.07	342	J	16.52173913		
DR032	PCB	57.4	1.79	140	J	7.82122905		
DR033		57.12	1.72	225	J	13.08139535		
DR034		60.79	1.84	347	J	18.85869565		
DR035	PCB	72.03	2.29	516	J	22.53275109		
DR036	release	7.88	3.37	66	J	1.958456973		
DR037		86.09	2.02	83	J	4.108910891		
DR038	release	77.9	2.62	336	J	12.82442748		
DR039		87.15	2.43	175		7.201646091		
DR040		70.1	4.69	776		16.54584222		*
DR041	release	88.52	2.43	222	J	9.135802469		
DR042	release	67.02	9.23	182		1.971830986		
DR043	PCB	56.88	4.48	270		6.026785714		
DR044	release	56.31	2.08	131		6.298076923		
DR045		43.81	2.92	107		3.664383562		
DR046	release	66.71	2.26	80		3.539823009		
DR047	PCB	48.18	1.4	158		11.28571429		
DR048	release	82.64	2.03	88		4.334975369		
DR049		85.76	2.64	120		4.545454545		
DR050	release	85.65	4.12	240	J	5.825242718		
DR051		35	2.77	50	U	1.805054152		
DR052		72.03	2.56	138		5.390625		
DR053		83.72	2.8	257	J	9.178571429		
DR054		70.1	2.36	97		4.110169492		
DR055	release	89.58	5.88	214		3.639455782		
DR056		90.34	1.89	60		3.174603175		

Normalized and Highest Background PCB SI Data

Sample	type	% fines	% TOC	PCB	Q	Normalized	Normalized release	Highest Release
DR057	release	62.41	1.79	139		7.765363128		
DR058	PCB	30.63	0.9	1144	J	127.1111111		1
DR059	release	91.98	2.73	210	J	7.692307692		
DR060		79.72	1.93	102	J	5.284974093		
DR061	release	82.01	2.65	145	J	5.471698113		
DR062	release	74.66	2.18	110	J	5.04587156		
DR063		88.09	2.62	302		11.52671756		
DR064		84.09	2.58	227		8.798449612		
DR065	release	81.56	2.41	185		7.676348548		
DR066		85.76	2.25	77	J	3.422222222		
DR067	release	25.46	0.82	40	U	4.87804878		
DR068		89.39	2.36	93	J	3.940677966		
DR069		86.91	1.92	119		6.197916667		
DR070	release	67.97	1.75	136		7.771428571		
DR071		83.77	2.16	68	J	3.148148148		
DR072		84.84	2.19	114		5.205479452		
DR073		78.23	2.49	154		6.184738956		
DR074		57.12	2.46	127		5.162601626		
DR075		60.79	2.31	118		5.108225108		
DR076	release	0.01	0.1	40	U	40		
DR077	release	69.42	1.61	120	J	7.453416149		
DR078		91.13	2.07	121	J	5.845410628		
DR079		93.5	2.18	187	J	8.577981651		
DR080		82.57	1.82	175	J	9.615384615		
DR081	PCB	58.4	1.78	1473	J	82.75280899		1
DR082	release	79.1	1.97	430	J	21.82741117		
DR083	release	84.74	2.29	567	J	24.75982533		
DR084	PCB	50.9	1.23	326	J	26.50406504		
DR085		61.2	1.29	413	J	32.01550388		
DR086	release	85.89	1.97	116	J	5.888324873		
DR087	PCB	57.4	1.67	696		41.67664671		1
DR088	PCB	74.99	1.68	1010	J	60.11904762		1
DR089		7.88	1.92	271		14.11458333		
DR090		87.15	2.13	66		3.098591549		
DR091	PCB	21.93	0.86	45		5.23255814		
DR092	PCB	22.1	0.7	64		9.142857143		
DR093		79.15	2.55	223		8.745098039		
DR094	PCB	37.39	1.02	393	J	38.52941176		
DR095		84.57	2.17	91	J	4.193548387		
DR096		72.64	1.95	172	J	8.820512821		
DR097	release	86.78	2.99	126	J	4.214046823		
DR098		84.71	1.84	69	J	3.75		
DR099	release	21.06	1.66	32		1.927710843		
DR100	release	20.52	0.61	40	U	6.557377049		
DR101		82.83	1.73	40	U	2.312138728		
DR102		59.97	2.15	108	J	5.023255814		
DR103		77.71	2.84	242	J	8.521126761		
DR104		75.08	2.82	177	J	6.276595745		
DR105		63.93	2.07	124	J	5.990338164		
DR106		89.04	2.43	227		9.341563786		
DR107		88.5	2.5	296		11.84		
DR108		88.66	2.33	258		11.07296137		
DR109		90.54	2.35	277	J	11.78723404		
DR110		82.84	2.67	284		10.63670412		
DR111	PCB	74.26	2.26	311		13.76106195		
DR112	release	79.41	2.64	243		9.204545455		

Normalized and Highest Background PCB SI Data

Sample	type	% fines	% TOC	PCB	Q	Normalized	Normalized release	Highest Release
DR113		104.99	2.72	2027	J	74.52205882		*
DR114		71.47	2.51	189	J	7.529880478		
DR115	PCB	46.35	1.3	142		10.92307692		
DR116		83.91	2.53	157	J	6.205533597		
DR117		83.74	2.6	204	J	7.846153846		
DR118		82.58	2.8	53	J	1.892857143		
DR119		85.68	2.69	390	J	14.49814126		
DR120	release	56.88	2.78	188		6.762589928		
DR121		95.03	2.39	98		4.10041841		
DR122		90.07	2.18	123		5.642201835		
DR123	PCB	74.84	2.42	900		37.19008264		1
DR124	PCB	24.17	2.78	161		5.791366906		
DR125		89.94	2.85	151		5.298245614		
DR126	release	84.27	3.09	181		5.857605178		
DR127		82.83	2.78	179		6.438848921		
DR128		67.97	2.99	167		5.585284281		
DR129		84.8	2.67	217		8.127340824		
DR130		82.64	2.87	157		5.470383275		
DR131	PCB	20.73	1.47	97	J	6.598639456		
DR132	release	77.46	2.9	129	J	4.448275862		
DR133		26.87	0.76	79		10.39473684		
DR134		80.36	2.52	108	J	4.285714286		
DR135	PCB	48.02	2.04	260	J	12.74509804		
DR136		69.21	2.55	79	J	3.098039216		
DR137		47.1	2.2	181	J	8.227272727		
DR138		13.39	0.47	187		39.78723404		
DR139	PCB	65.96	2.96	2840		95.94594595		1
DR140		2.06	0.09	40	U	44.44444444		
DR141		49.12	2.27	68	J	2.995594714		
DR142	release	6.03	0.35	40	U	11.42857143		
DR143	release	16.12	0.82	25		3.048780488		
DR144		70.29	1.84	308		16.73913043		
DR145		85.22	2.46	204		8.292682927		
DR146		86.78	2.63	125	J	4.752851711		
DR147		84.99	2.71	345		12.73062731		
DR148		61.62	4.51	279	J	6.186252772		
DR149	release	67.38	2.01	95	J	4.726368159		
DR150		80.54	2.18	137	J	6.28440367		
DR151		83.2	2.68	325	J	12.12686567		
DR152		90.8	2.37	124		5.232067511		
DR153		88.47	2.19	113		5.159817352		
DR154		81.09	2.33	101	J	4.334763948		
DR155	release	80.21	2.7	106	J	3.925925926		
DR156		79.95	2.75	92	J	3.345454545		
DR157	PCB	47.51	5.47	4707		86.0511883		1
DR158		40.09	1.26	75	J	5.952380952		
DR159		73.58	2.76	118	J	4.275362319		
DR160	release	67.02	2.41	115		4.771784232		
DR161		88.58	2.87	24		0.836236934		
DR162		70.29	1.9	146		7.684210526		
DR163		90.11	2.3	72		3.130434783		
DR164		84.54	2.58	64	J	2.480620155		
DR165		76.65	2.36	57	J	2.415254237		
DR166		56.96	1.47	95	J	6.462585034		
DR167	PCB	40.73	1.53	139	J	9.08496732		
DR168		63.34	3.1	120	J	3.870967742		



Normalized and Highest Background PCB SI Data

Sample	type	% fines	% TOC	PCB	Q	Normalized	Normalized release	Highest Release
DR169		64.14	2.01	65	J	3.233830846		
DR170		76.55	2.04	51	J	2.5		
DR171		80.5	2.47	103	J	4.170040486		
DR172		3.79	0.24	40	U	16.66666667		
DR173	PCB	24.66	0.87	62	J	7.126436782		
DR174	PCB	50.58	1.59	494		31.06918239		
DR175	release	64.35	1.74	120		6.896551724		
DR176	release	76.2	2.62	219		8.358778626		
DR177	PCB	85.85	2.87	632	J	22.02090592		1
DR178	PCB	78.69	3.44	7044	J	204.7674419	1	1
DR179	PCB	77.82	2.83	3358	J	118.6572438		1
DR180	PCB	69.37	2.63	527	J	20.03802281		
DR181		76.19	2.34	1672	J	71.45299145		*
DR182		52.54	4.54	318	J	7.004405286		
DR183		68.66	1.8	122	J	6.777777778		
DR184		90.86	2.21	139	J	6.28959276		
DR185	release	86.56	1.96	75		3.826530612		
DR186	PCB	66.31	2.01	1178		58.60696517		1
DR187	PCB	32.13	1.9	246		12.94736842		
DR188		80.98	1.75	104		5.942857143		
DR189	release	41.05	1.38	93		6.739130435		
DR190		63.41	1.9	56	J	2.947368421		
DR191	release	84.91	2.19	77		3.515981735		
DR192		58.36	2.63	112		4.258555133		
DR193		40.41	1.21	118		9.752066116		
DR194		86.9	3.06	155		5.065359477		
DR195		48.7	1.37	64	J	4.671532847		
DR196		41.47	1.17	115		9.829059829		
DR197		44.85	1.3	98		7.538461538		
DR198		38.67	1.54	85		5.519480519		
DR199		54.14	1.45	69		4.75862069		
DR200		55.69	1.73	83		4.797687861		
DR201	PCB	53.27	1.7	655		38.52941176		1
DR202		44.53	1.57	98		6.242038217		
DR203		42.84	1.06	101		9.528301887		
DR204		43.18	1.09	40		3.669724771		
DR205		83.54	2.22	35		1.576576577		
DR206		91.81	2.97	205		6.902356902		
DR207	PCB	28.22	3.17	12000		378.5488959	1	1
DR208	PCB	45.34	1.29	388		30.07751938		
DR209	PCB	12.88	1.03	67		6.504854369		
DR210	PCB	60.47	1.45	375		25.86206897		
DR211		72.91	1.56	56		3.58974359		
DR212		44.76	1.5	77	J	5.133333333		
DR213		51.33	1.25	136	J	10.88		
DR214		56.83	1.53	111	J	7.254901961		
DR215		80.16	2.16	107	J	4.953703704		
DR216		86.15	2.13	313		14.69483568		
DR217	PCB	54.97	1.67	4200	J	251.497006	1	1
DR218		89.54	2.56	87	J	3.3984375		
DR219	release	87.85	2.22	186		8.378378378		
DR220		86.31	2.76	77		2.789855072		
DR221	release	73.58	1.57	64	J	4.076433121		
DR222		36.31	0.95	132		13.89473684		
DR223		80.04	2.09	153		7.320574163		
DR224		46.6	1.17	57		4.871794872		

Normalized and Highest Background PCB SI Data

Sample	type	% fines	% TOC	PCB	Q	Normalized	Normalized release	Highest Release
DR225		71.33	1.73	145		8.38150289		
DR226		45.77	1.77	113		6.384180791		
DR227		80.77	2	25		1.25		
DR228		84.16	2.48	161	J	6.491935484		
DR229		67.65	2.04	22		1.078431373		
DR230		85.68	2.4	86		3.583333333		
DR231		74.88	2.17	102	J	4.700460829		
DR232	release	43.61	1.37	81		5.912408759		
DR233		75.28	2.19	149	J	6.803652968		
DR234		54.74	1.77	54	J	3.050847458		
DR235		79.09	1.92	75		3.90625		
DR236		33.51	0.85	129		15.17647059		
DR237		47.21	1.46	98		6.712328767		
DR238		85.47	1.78	40	U	2.247191011		
DR239	release	64.18	1.69	22		1.301775148		
DR240		96.5	3.6	95	J	2.638888889		
DR241		96.63	3.56	77	J	2.162921348		
DR242		100.73	3.5	93	J	2.657142857		
DR243		96.71	3.66	118	J	3.224043716		
DR244		97.01	3.52	133	J	3.778409091		
DR245		94.84	3.43	105	J	3.06122449		
DR246		93.92	3.63	20		0.550964187		
DR247		88.33	1.99	63		3.165829146		
DR248		83.68	2.28	72		3.157894737		
DR249		71.2	1.48	40	U	2.702702703		
DR251		67.36	1.88	71		3.776595745		
DR252		33.9	1.67	40	U	2.395209581		
DR253		56.43	1.56	53		3.397435897		
DR254		1.32	1.9	40	U	2.105263158		
DR255		69.08	1.81	45		2.486187845		
DR256		65.37	2.06	42		2.038834951		
DR257		0.01	0.15	40	U	26.66666667		
DR258		52.77	1.55	62		4		
DR259		84.1	2.94	123		4.183673469		
DR260		89.2	3.09	80		2.588996764		
DR261		74.84	2.48	83		3.346774194		
DR262		69.77	2.46	52	J	2.113821138		
DR263		80.58	2.9	50	J	1.724137931		
DR264		55.4	1.48	51		3.445945946		
DR265		34.96	1.03	40	U	3.883495146		
DR266		54.45	1.38	51		3.695652174		
DR267	release	34.69	0.85	21		2.470588235		
DR269		28.81	0.9	40	U	4.444444444		
DR270		34.44	1.32	40	U	3.03030303		
DR271	PCB	36.42	2.61	<b>9400</b>		<b>360.1532567</b>	I	I
DR276	release	32.83	1.51	32		2.119205298		
DR277		89.18	1.86	91		4.892473118		
DR278		90.48	3.27	80		2.44648318		

Normalized and Highest Background PCB SI Data

Sample	type	% fines	% TOC	PCB	Q	Normalized	Normalized release	Highest Release
DR279		79.24	1.82	53		2.912087912		
DR280		83.53	2.53	72		2.845849802		
DR282		83.58	2.58	87		3.372093023		
DR283		77.44	2.47	68		2.753036437		
DR284		67.03	2.23	61		2.735426009		
DR285		83.62	3.39	53	J	1.563421829		
DR286		58.19	1.42	54		3.802816901		
DR287		55.84	1.31	25		1.908396947		
DR288		85.64	2.97	83		2.794612795		
DR289		80.69	3.63	58		1.597796143		
DR291		58.79	3.79	127		3.350923483		
DR292		75.47	5.29	254		4.801512287		
DR294		3.29	0.15	40	U	26.66666667		
DR295		0.01	0.15	40	U	26.66666667		
DR296		0.01	0.65	40	U	6.153846154		
Totals							4	17

**Backgrounds**

DR250	background	76.68	1.89	40	U	2.116402116
DR268	background	54.86	2.1	34		1.619047619
DR272	background	55.9	0.11	52		47.27272727
DR273	background	43.47	1.66	45		2.710843373
DR274	background	31.76	1.39	40	U	2.877697842
DR275	background	37.56	1.06	40	U	3.773584906
DR281	background	78.63	3.64	193		5.302197802
DR290	background	77.59	4.01	170		4.239401496
DR293	background	43.74	3.328	165.89286	U	4.984440391
DR297	background	0.01	3.627	185.70238	U	5.119629788
DR298	background	0.01	3.926	205.5119	U	5.234225766
DR299	background	0.01	4.225	225.32143	U	5.332600795
DR300	background	0.01	4.524	245.13095	U	5.41797132
DR301	background	0.01	0.08	40	U	50

41 PCB hits in doc record

17 using highest background

4 using highest normalized background

**Attachment H**  
**IRIS information for Aroclor 1254**



## Aroclor 1254

### CASRN 11097-69-1

#### Contents

- I.A. REFERENCE DOSE FOR CHRONIC ORAL EXPOSURE (RfD)
- I.B. REFERENCE CONCENTRATION FOR CHRONIC  
INHALATION EXPOSURE (RfC)
- II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE
- VI. BIBLIOGRAPHY
- VII. REVISION HISTORY
- VIII. SYNONYMS

0389

Aroclor 1254; CASRN 11097-69-1

Health assessment information on a chemical substance is included in IRIS only after a comprehensive review of chronic toxicity data by U.S. EPA health scientists from several Program Offices and the Office of Research and Development. The summaries presented in Sections I and II represent a consensus reached in the review process. Background information and explanations of the methods used to derive the values given in IRIS are provided in the Background Documents.

#### STATUS OF DATA FOR Aroclor 1254

File On-Line 10/01/1994

Category (section)	Status	Last Revised
Oral RfD Assessment (I.A.)	on-line	11/01/1996
Inhalation RfC Assessment (I.B.)	no data	
Carcinogenicity Assessment (II.)	no data	

## **I. CHRONIC HEALTH HAZARD ASSESSMENTS FOR NONCARCINOGENIC EFFECTS**

### **I.A. REFERENCE DOSE FOR CHRONIC ORAL EXPOSURE (RfD)**

Substance Name -- Aroclor 1254  
 CASRN -- 11097-69-1  
 Primary Synonym -- PCBs, Polychlorinated Biphenyls  
 Last Revised -- 11/01/1996

The oral Reference Dose (RfD) is based on the assumption that thresholds exist for certain toxic effects such as cellular necrosis. It is expressed in units of mg/kg-day. In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. Please refer to the Background Document for an elaboration of these concepts. RfDs can also be derived for the noncarcinogenic health effects of substances that are also carcinogens. Therefore, it is essential to refer to other sources of information concerning the carcinogenicity of this substance. If the U.S. EPA has evaluated this substance for potential human carcinogenicity, a summary of that evaluation will be contained in Section II of this file.

#### **I.A.1. ORAL RfD SUMMARY**

Critical Effect	Experimental Doses*	UF	MF	RfD
-----	-----	----	----	-----
Ocular exudate, inflamed and prominent Meibomian glands, distorted growth of finger and toe nails; decreased antibody (IgG and IgM) response to sheep erythrocytes	NOAEL: None LOAEL: 0.005 mg/kg-day	300	1	2E-5 mg/kg-day
Monkey Clinical and Immunologic Studies				
Arnold et al., 1994a,b; Tryphonas et al., 1989, 1991a,b				
*Conversion Factors and Assumptions -- None				

## I.A.2. PRINCIPAL AND SUPPORTING STUDIES (ORAL RfD)

Arnold, D.L., F. Bryce, R. Stapley et al. 1993a. Toxicological consequences of Aroclor 1254 ingestion by female Rhesus (*Macaca mulatta*) monkeys, Part 1A: Prebreeding phase - clinical health findings. *Food Chem. Toxicol.* 31: 799-810.

Arnold, D.L., F. Bryce, K. Karpinski et al. 1993b. Toxicological consequences of Aroclor 1254 ingestion by female Rhesus (*Macaca mulatta*) monkeys, Part 1B: Prebreeding phase - clinical and analytical laboratory findings. *Food Chem. Toxicol.* 31: 811-824.

Tryphonas, H., S. Hayward, L. O'Grady et al. 1989. Immunotoxicity studies of PCB (Aroclor 1254) in the adult rhesus (*Macaca mulatta*) monkey -- preliminary report. *Int. J. Immunopharmacol.* 11: 199-206.

Tryphonas, H., M.I. Luster, G. Schiffman et al. 1991a. Effect of chronic exposure of PCB (Aroclor 1254) on specific and nonspecific immune parameters in the rhesus (*Macaca mulatta*) monkey. *Fund. Appl. Toxicol.* 16(4): 773-786.

Tryphonas, H., M.I. Luster, K.L. White et al. 1991b. Effects of PCB (Aroclor 1254) on non-specific immune parameters in Rhesus (*Macaca mulatta*) monkeys. *Int. J. Immunopharmacol.* 13: 639-648.

Groups of 16 adult female rhesus monkeys ingested gelatin capsules containing Aroclor 1254 (Monsanto Lot No. KA634) in 1:1 glycerol: corn oil vehicle daily at dosages of 0, 5, 20, 40 or 80 ug/kg-day for more than 5 years. The Aroclor mixture contained 5.19 ppm of polychlorinated dibenzofurans and undetectable levels of polychlorinated dibenzo-p-dioxins (Truelove et al., 1990). At study initiation the monkeys were 11.1 +/- 4.1 years old (Tryphonas et al., 1991a,b; Arnold et al., 1993a,b). After 25 months of exposure the monkeys had achieved a pharmacokinetic steady-state based on PCB concentrations in adipose tissue and/or blood (Tryphonas et al., 1989). Results of general health and clinical pathology evaluations conducted during the first 37 months of exposure were reported by Arnold et al. (1993a,b). Results of immunologic assessments after 23 and 55 months of exposure were reported by Tryphonas et al. (1989, 1991a,b). Results of reproductive endocrinology evaluations after 24 or 29 months of exposure were reported by Truelove et al. (1990) and Arnold et al. (1993a). Effects on hydrocortisone levels during the first 22 months of exposure were reported by Loo et al. (1989) and Arnold et al. (1993b). All of the aforementioned evaluations were performed during the prebreeding phase of the study. Results of reproduction and histopathology evaluations in these monkeys are not fully available (Arnold, 1992).

General health status was evaluated daily, and body weight measurements, feed conversion ratio calculations, and detailed clinical evaluations were performed weekly throughout the study. Analyses of clinical signs of toxicity were limited to the occurrence of eye exudate, inflammation and/or prominence of the eyelid Meibomian (tarsal) glands, and particular changes in finger and toe nails (prominent nail beds, separation from nail beds, elevated nail beds, and nails folding on themselves). Each endpoint was analyzed for individual treatment-control group differences and dose-related trends with respect to incidence rate, total frequency of observed occurrences, and the onset time of the condition. With respect to effects on the eyes, the treatment-control group comparisons showed statistically significant (p less than or equal to 0.05) increases in the total frequency of inflamed and/or prominent Meibomian glands at 0.005, 0.02 and 0.08 mg/kg-day, and decreased onset time for these effects at 0.08 mg/kg-day. Significant dose-related trends (p less than or equal to 0.05) were observed for increased total frequencies of inflamed and/or prominent Meibomian glands, decreased onset time of inflamed and/or

prominent Meibomian glands, and increased incidences of eye exudate. With respect to effects on finger and/or toe nails, the treatment-control group comparisons showed significantly ( $p$  less than or equal to 0.05) increased incidence of certain nail changes at 0.005 mg/kg-day (nail folding) and 0.08 mg/kg-day (elevated nails), increased total frequency of certain nail changes at 0.005 mg/kg-day (nail separation), 0.04 mg/kg-day (nail folding and separation) and 0.08 mg/kg-day (nail folding and separation, prominent beds, elevated nails), and decreased onset time of certain nail changes at 0.005 mg/kg-day (elevated nails) and 0.08 mg/kg-day (nail folding, prominent beds, elevated nails). Significant dose-related trends ( $p$  less than or equal to 0.05) were observed for certain nail changes (prominent beds, elevated nails) when adjusted for onset time, total frequencies of certain nail changes (nail folding and separation, prominent beds, elevated nails), and decreases in onset time of certain nail changes (nail folding, prominent beds, elevated nails).

Immunologic assessment showed significant ( $p < 0.01$  or  $< 0.05$ ) reductions in IgG (at all doses of Aroclor 1254) and IgM (all doses but 0.02 mg/kg-day) antibody levels in response to injected sheep red blood cells (SRBC) after 23 months of exposure (Tryphonas et al., 1989). A significant ( $p < 0.05$ ) decrease in the percent of helper T-lymphocytes, a significant ( $p < 0.05$ ) increase in the percent and absolute level of suppressor T-lymphocytes (TS) and a significant ( $p < 0.01$ ) reduction in TH/TS ratio was observed at 0.08 mg/kg-day. The antibody response to SRBC is an antigen-driven response that requires the interaction of several distinct cell types (i.e., antigen processing and presentation by macrophages, participation by T-helper cells and finally proliferation and differentiation of B cells into plasma cells that secrete the antibody), which result in the production and secretion of antibodies specific for SRBC from plasma cells. Perturbation in any of the cells or cell-to-cell interactions by physical, chemical or biological agents can result in aberrant antibody responses. The necessity for the interaction of the three principal cells of the immune system (i.e., macrophage, B lymphocyte and T lymphocyte), in response to SRBC, is the main reason why this response has been so widely used in immunotoxicity testing as a surrogate for infection with a pathogenic organism.

In a recent evaluation of the sensitivity and predictability of various immune function assays used for immunotoxicity testing in the mouse (Luster et al., 1992), the antibody plaque-forming cell (PFC) response to SRBC was found to show the highest association with immunotoxic compounds. Essentially this means that the antibody PFC response to SRBC is a very good predictor of immunotoxicants. Also, it has recently been demonstrated that measurement of serum antibody titer to SRBC using the ELISA assay is as sensitive as the PFC assay for determining the response to SRBC (Butterworth et al., 1993).

There were no exposure-related effects on total B-lymphocytes, total T-lymphocytes, total serum immunoglobulin levels, total serum protein, serum protein fractions after 23 months. No exposure-related effects on serum hydrocortisone levels were observed although the SRBC assay is considered a good surrogate (Tryphonas et al., 1989; Loo et al., 1989; Arnold et al., 1993b).

After 55 months of exposure, there was a significant dose-related decrease ( $p < 0.0005$  for pairwise comparisons and trend test) in the IgM antibody response to injected SRBC at greater than or equal to 0.005 mg/kg-day at all times of evaluation (1-4 weeks postimmunization) (Tryphonas et al., 1991a). IgG antibody response to injected SRBC was significantly ( $p < 0.01$ ) decreased only at 0.04 mg/kg-day, although the overall trend for dose-response was significant ( $p = 0.033$ ). The antibody response to pneumococcus antigen did not differ significantly among all test groups (including controls) at any time tested and showed no dose-related trend. However, the antibody response to pneumococcus antigen is a T cell-independent response and the fact that there is no change with this antigen is not inconsistent with the depressed response



to the T cell-dependent SRBC antigen. Other data corroborate the significance of Aroclor 1254 suppression of the antibody response to SRBC and point to effects on T lymphocytes including the dose-related suppression of the Con A and PHA lymphoproliferative responses. The monkeys treated with greater than or equal to 0.005 mg/kg-day had significantly ( $p < 0.0001$ ) lower mean percentage levels of total T-lymphocytes and significant trend for dose-response, but absolute numbers of T-lymphocytes were similar among test groups. Flow cytometric analysis showed no treatment-related effects on peripheral blood T-helper, T-suppressor or B-lymphocytes or TH/TS lymphocyte ratio. A statistically significant, dose-related increase was noted for thymosin alpha-1-levels but not for thymosin beta-2-levels. Serum complement activity was significantly ( $p < 0.025$ ) increased at greater than or equal to 0.005 mg/kg-day but showed no significant ( $p = 0.1$ ) dose-related trend. Natural killer cell activity at effect or target ratios of 25:1, 50:1 or 75:1 was not significantly ( $p > 0.05$ ) increased at any dosage, although there was a significant ( $p = 0.03$ ) dose-related trend. No signs of microbial infection were noted in any of the preceding reports.

Clinical pathology was evaluated during the first 37 months of the study (Arnold et al., 1993b). These evaluations included monthly measurements of hematology and serum biochemistry (including serum protein, RBC indices, semi-monthly measurements of thyroid function, and daily measurements of urinary porphyrins during the 33rd month of dosing). Significant ( $p \leq 0.05$ ) decreases in average dose-group values compared with controls were found for serum cholesterol at 0.04 mg/kg-day, and reticulocyte count, serum cholesterol, total bilirubin, and alpha-1 + alpha-2-globulins at 0.08 mg/kg-day. Significant dose-related decreasing linear trends were also observed for reticulocyte count ( $p = 0.002$ ), cholesterol ( $p$  less than or equal to 0.001), and total bilirubin ( $p = 0.005$ ). Dose-related decreasing linear trends were also observed for red blood cell count ( $p = 0.019$ ), mean platelet volume ( $p = 0.034$ ), hematocrit ( $p = 0.064$ ), hemoglobin concentration ( $p = 0.041$ ). With regard to thyroid endpoints [serum thyroxine (T4), serum triiodothyronine (T3) uptake ratio, percent T3 uptake, and free thyroxine index], dose-response analysis consisted of group mean comparisons and an assessment of parallelism in the response profiles (an absence of parallelism would indicate time-dose interactive effects). No statistically significant changes were observed for any of the thyroid endpoints.

After approximately 2 years of dosing, each dose group was randomly divided into two test groups for daily analyses of serum progesterone and estrogen concentrations during one menstrual cycle (Truelove et al., 1990; Arnold et al., 1993b). There were no statistically significant differences between treated and control monkeys in menstrual cycle length or menses duration, and no apparent treatment-related effects on incidence of anovulatory cycles or temporal relationship between estrogen peak and menses onset, menses end or progesterone peak (Truelove et al., 1990; Arnold et al., 1993a,b).

To summarize the above, monkeys that ingested 0.005-0.08 mg/kg-day doses of Aroclor 1254 showed ocular exudate, prominence and inflammation of the Meibomian glands and distortion in nail bed formation. These changes were seen at the lowest dose tested, 0.005 mg/kg-day, and a dose-dependent response was demonstrated. Similar changes have been documented in humans for accidental oral ingestion of PCBs. Among the various immunologic function tests that were performed, the increases in IgM and IgG antibodies to sheep erythrocytes are most significant. IgG and IgM antibodies in response to SRBC were reduced after 23 months of exposure but only the IgM antibodies were clearly decreased after 55 months. Particular importance is attributed to the immune response to sheep erythrocytes since it involves participation by the three principal cells of the immune system: the macrophage, B lymphocytes and T lymphocytes and has been shown to be the most predictive immunotoxicity test of those currently in use (Luster et al., 1992). On the basis the studies described, a LOAEL of 0.005 mg/kg-day was established for Aroclor 1254.

### I.A.3. UNCERTAINTY AND MODIFYING FACTORS (ORAL RfD)

UF -- A 10-fold factor is applied to account for sensitive individuals. A factor of 3 is applied to extrapolation from rhesus monkeys to humans. A full 10-fold factor for interspecies extrapolation is not considered necessary because of similarities in toxic responses and metabolism of PCBs between monkeys and humans and the general physiologic similarity between these species. A partial factor is applied for the use of a minimal LOAEL since the changes in the periocular tissues and nail bed seen at the 0.05 mg/kg-day are not considered to be of marked severity. The duration of the critical study continued for approximately 25% of the lifespan of rhesus monkeys so that a reduced factor was used for extrapolation from subchronic exposure to a chronic RfD. The immunologic and clinical changes that were observed did not appear to be dependent upon duration which further justifies using a factor of 3 rather than 10 for extrapolation from subchronic to chronic, lifetime exposure. The total UF is 300.

MF -- None

### I.A.4. ADDITIONAL STUDIES / COMMENTS (ORAL RfD)

Human data available for risk assessment of Aroclor 1254 are useful only in a qualitative manner. Studies of the general population who were exposed to PCBs by consumption of contaminated food, particularly neurobehavioral evaluations of infants exposed in utero and/or through lactation, have been reported, but the original PCB mixtures, exposure levels and other details of exposure are not known (Kreiss et al., 1981; Humphrey, 1983; Fein et al., 1984a,b; Jacobson et al., 1984a, 1985, 1990a,b; Rogan et al., 1986; Gladen et al., 1988). Most of the information on health effects of PCB mixtures in humans is available from studies of occupational exposure. Some of these studies examined workers who had some occupational exposure to Aroclor 1254, but sequential or concurrent exposure to other Aroclor mixtures nearly always occurred, exposure involved dermal as well as inhalation routes (relative contribution by each route not known), and monitoring data are lacking or inadequate (Alvares et al., 1977; Brown and Jones, 1981; Colombi et al., 1982; Fischbein et al., 1979, 1982, 1985; Fischbein, 1985; Warshaw et al., 1979; Smith et al., 1982; Taylor et al., 1984; Lawton et al., 1985). Insufficient data are available in these studies to determine possible contributions of Aroclor 1254 alone, extent of direct skin exposure and possible contaminants. However, it is relevant to note that dermal and ocular effects, including skin irritation, chloracne, hyperpigmentation and eyelid and conjunctival irritation, have been observed in humans occupationally exposed to Aroclor 1254 and other Aroclor formulations.

Aroclor 1254 was fed to groups of eight female and four male adult rhesus monkeys once daily in dosages of 0, 5, 25 or 100 ug/kg for 14 months, followed by an observation period of 7 months (Levinskas et al., 1984). The Aroclor 1254 was dissolved in corn oil and offered to the animals in apple sauce prior to each day's feeding, and the control mixture (corn oil in applesauce) was used during the observation period. Dosages were adjusted biweekly for changing body weight as necessary. The monkeys were selected on the basis of a successful reproductive history, estimated to be at least 6 years old, and had been in captivity for 2-9 years. After 6 months of treatment the monkeys

were bred to untreated males or females from the same colony over an 8-month period and offspring were observed for 2 months. Breeding was continued until conception was diagnosed by digital examination of the uterus and alterations in the menstrual cycle. Evaluations of adult animals included hematology and clinical chemistry. Urinalysis was also performed every 3 months during the study. Semen analyses were performed monthly from just prior to the start of treatment until the end of the treatment period. After 2 months of observation; sperm concentration, total sperm, sperm motility, percent abnormal cells and live/dead ratios were evaluated. Based upon these parameters, no effect was observed upon male reproductive capacity. Necropsies including histological examinations were performed on all adult animals that died during the study or were euthanized at the end of the observation period. Birth weight and somatic measurements were taken for all offspring of exposed females or males. The infants of the exposed females were subsequently evaluated monthly for body weight and complete blood cell counts were performed. Infants that did not show signs of intoxication were euthanized after 2 months and those showing signs were weaned, observed for reversal of signs, and euthanized at the end of the study along with the adults. Necropsies including histological examinations were performed on all infants that died or were euthanized.

Death or euthanasia in extremis occurred in 1/12, 0/12, 1/12 and 5/12 of the adult monkeys in the control, low-, mid- and high-dose groups, respectively. All of the deaths occurred in females except for one male in the high-dose group, and the only deaths considered to be related to treatment were in four of the high-dose animals (3 females, 1 male). Characteristic signs of PCB intoxication developed in the high-dose group after 9 months of exposure, including effects on the eyelids (redness and/or edema, wrinkling) in approximately half the animals and swelling of the lips in all animals. Other characteristic signs included bleeding gums, abnormal fingernail/toenail growth pattern and increased alopecia (including eyelashes) in several of the high-dose monkeys. In general, the signs of intoxication appeared to subside during the post-treatment period. Some of the monkeys in the mid-dose group showed signs of intoxication (swelling of the lips in one male and one female) after 15 and 18 months, respectively, and alopecia and abnormal nail growth, but no signs attributable to exposure occurred in the low-dose group. Hematologic effects at the high dose were observed including reduced packed cell volume, erythrocyte count, hemoglobin and platelet counts. In addition, increased serum iron and reduced serum cholesterol were observed, particularly in the monkeys that died. Some of the high-dose monkeys also had prolonged bleeding and improper healing at biopsy sites. Dermal histological changes characteristic of PCB poisoning were prominent in the high-dose group, occurring in 11/12 monkeys (8 females, 3 males), and included loss of secretory epithelium in the Meibomian (eyelid) glands and sebaceous glands, partial or total atrophy of sebaceous glands, follicular keratosis and/or squamous cysts. Dermal changes also occurred in four of the mid-dose monkeys, but not in the low-dose or control groups. Other histological alterations included squamous metaplasia in glandular ducts of the tongue or lip (3 high-dose females, 1 high-dose male), subgingival epithelial cysts of the mandible (1 high-dose male, 1 high-dose female, 1 mid-dose male) and hyperplasia in the bile and pancreatic ducts and gall bladder (1 high-dose female). Nonspecific bone marrow alterations (decreased cellularity and/or granulocyte maturation) occurred in 6/12 high-dose monkeys (5 females, 1 male) and may have been compound-related because they correlated with the hematologic changes.

There was no apparent effect on male fertility based on conception rate following matings with the untreated females or the semen analyses (Levinskas et al., 1984). In the female control, low-, mid- and high-dose groups, the numbers of known pregnancies were 7, 7, 7 and 5, respectively, the numbers of live births were 6, 5, 7 and 1, respectively. Analysis of the preceding data showed that there was a statistically significant reduction in fertility in the high-dose group; this analysis refers only to the decreased number of live births. There was a clear exposure-related effect on birth weight and infant

body weight gain. When compared with control group infants (mean birth weight 495.2 g) the 0.025 mg/kg-day infants (mean birth weight 392.2 g) showed a statistically significant reduction in birth weight ( $p < 0.005$ ). Most of the infants in the mid-dose group and all of the infants in the high-dose had abnormal clinical signs. These changes included being born with or developed dermal signs that were consistent with those in the adults (e.g., swollen lips, swollen eyelids and/or scanty eyelashes) and more severe at the high dose, and also developed pulmonary signs (e.g., respiratory wheezing). Histological changes in the infants were generally similar to those observed in the adults. These effects included changes in the Meibomian and sebaceous glands, pancreatic ducts and bone marrow. Other histological changes included thymic atrophy in one mid-dose and the high-dose infant, and other effects in the high-dose infant (e.g., retarded kidney cortical maturation, bile duct hyperplasia and gastric mucosal gland cysts).

To summarize the above, no treatment-related effects were observed in the low-dose adults or their infants, indicating that 0.005 mg/kg-day is a NOAEL. For the mid-dose infants there was a 15% reduction in birth weight of infants that was statistically significant ( $p < 0.005$ ). When these infants reached 2 months of age the reduced body weight was 22% below controls and this difference was also found to be statistically significant ( $p = 0.05$ ). Ocular and dermal signs and/or histological changes characteristic of PCB intoxication developed in a some adults receiving 25 and 100 ug/kg-day, as well as in most of the infants in these groups. Based on these effects the 0.025 mg/kg-day dosage is a LOAEL. Other effects at the high dose included decreased adult survival, female fertility and numbers of live births, indicating that 0.1 mg/kg-day is a FEL. This FEL is supported by results of the Truelove study (Truelove et al., 1982).

Aroclor 1254 was fed to 1, 2 or 1 pregnant rhesus monkeys in reported average daily doses of 0, 0.1 or 0.2 mg/kg-day, respectively, 3 days/week for up to 267 days starting on gestation day 60 (Truelove et al., 1982). The exposure period included gestation and lactation. One of the adult monkeys in the low-dose group and the one adult in the high-dose group lost their fingernails after 233 and 242 days of PCB treatment, but other overt signs of intoxication were not observed. There was a significant reduction in antibody production in response to injected SRBC in the exposed monkeys, but levels of antibody production to tetanus toxoid were not appreciably different from control. The two low-dosage monkeys delivered dead infants. The infant of the high-dosage monkey died at age 139 days; this infant showed impaired immune function as assessed by antibody production following SRBC injections. Hematological evaluation performed bimonthly following parturition in adults and the surviving infant were inconclusive. Although evaluation of the dead infants and other results of this study is complicated by the small number of animals, the characteristic dermal sign of PCB toxicity in the exposed monkeys and lack of effects in controls strongly indicate that the developmental toxicity is exposure-related. Therefore, based on the stillbirths, 0.1 mg/kg-day is a FEL in monkeys.

Groups of four young adult female rhesus monkeys were fed 0 or 0.28 mg/kg doses of Aroclor 1254 for 5 days/week for 114-121 weeks (Tryphonas et al., 1986a,b; Arnold et al., 1990). Groups of four mature adult female cynomolgus monkeys that had a poor breeding history were similarly exposed for 55-58 weeks (Tryphonas et al., 1986a; Arnold et al., 1990). The Aroclor mixture contained no detectable polychlorinated dibenzo-p-dioxin contaminants. Adjusting for the partial weekly exposure gives an average daily dosage of 0.2 mg/kg-day. Prominent clinical signs appeared in all exposed rhesus monkeys during the first 2-12 months of exposure, including facial and periorbital edema, loss of eyelashes, Meibomian gland enlargement and impaction, conjunctivitis, nail lesions progressing from dryness to detachment and gingival hyperplasia and necrosis of varying severity. Two of the exposed rhesus monkeys developed overwhelming infections of the eye or periodontal tissue after 27 months of exposure prompting sacrifice within 48 hours. The

hematology and serum biochemistry evaluations showed various changes in the exposed rhesus monkeys, particularly slight or moderate normocytic anemia, depressed erythropoiesis in bone marrow and increased triglycerides and SGOT. The immunologic testing was inconclusive due to large interspecies variability. Pathology findings in the exposed rhesus monkeys included effects in the liver of three monkeys (30-55% increased relative liver weight, hepatocellular hypertrophy and necrosis, bile duct epithelial hypertrophy and hyperplasia, gall bladder epithelial hypertrophy), thyroid of two monkeys (enlargement, occasional follicular cell desquamation) and stomach of two monkeys (hypertrophic gastropathy). The cynomolgus monkeys had effects that were generally consistent with but less extensive and severe than those observed in the rhesus monkeys. After 38 weeks of exposure the rhesus monkeys were mated with untreated males; cynomolgus monkeys were not mated. The control and exposed rhesus monkeys became pregnant within 7 and 8 matings, respectively. Following extended post-implant bleeding all of the treated rhesus monkeys aborted within 30-60 days of gestation. Following recovery from the abortions the monkeys were bred again up to a maximum of seven times but none appeared to conceive. The menstrual cycle lengths and durations became erratic and longer during and subsequent to the breeding. Based on the abortions, reproductive impairment and pronounced overt signs of toxicity, the 0.2 mg/kg-day dosage is an FEL in monkeys.

Aulerich and Ringer (1977) performed a breeding study in which groups of eight female and two male adult mink were fed diets containing 0 or 2 ppm Aroclor 1254 for 39 weeks or until the kits were 4 weeks of age. The Aroclor was dissolved in acetone which was evaporated from the diet prior to feeding. Using assumed values of 150 g/day for food consumption and 0.8 kg for body weight for female mink (Bleavins et al., 1980), the estimated dosage of Aroclor 1254 is 0.4 mg/kg-day. Approximately monthly determinations reportedly showed no statistically significant ( $p < 0.05$ ) differences between the control and treated mink in body weight gain, hemoglobin, and hematocrit. Only two of seven mated females gave birth, producing one infant each. Of the two infants, one was born dead and the other had low body weight and was dead by age 4 weeks. Based on the reproductive and/or fetal toxicity resulting in nearly complete lack of births, 0.4 mg/kg-day is a FEL for Aroclor 1254 in mink.

Twelve female and four male adult ranch-bred mink (age 8 months, body weight not reported) were fed a diet containing 1 ppm Aroclor 1254 for 6 months (Wren et al., 1987a,b). Groups of 15 females and five males were used for unexposed controls. The mink were bred after approximately 12-14 weeks of exposure and exposure was continued until weaning at age 5 weeks. Using assumed values for food consumption and for body weight for female mink (Bleavins et al., 1980), the estimated dosage of Aroclor 1254 is 0.15 mg/kg-day. Offspring mortality during the first week of life was 75.8% higher in the exposed group than in the controls. Average body weight was significantly lower in the exposed offspring at age 3 and 5 weeks, but not at age 1 week, suggesting that transfer of PCBs by lactation may have contributed to the effect. There were no exposure-related effects on adult survival or mating performance, number of offspring per female mated or female that delivered, adult thyroid plasma T3 or T4 levels during the exposure period, adult scrotal diameter, offspring survival or relative liver weight at weaning or organ weights or histology (brain, kidney, adrenal, pituitary, thyroid). Teratogenicity was not evaluated. The neonatal mortality indicates that 0.15 mg/kg-day is an FEL in mink.

Groups of 10 female Sprague-Dawley rats were fed 0, 1, 5, 10 or 50 ppm Aroclor 1254 in the diet for approximately 5-6 months (Byrne et al., 1987). The Aroclor was dissolved in acetone which was evaporated from the diet prior to feeding. Based on reported body weight and food consumption data the dosages are estimated to be 0.09, 0.43, 0.61 and 4.3 mg/kg-day. Serum thyroxine (T4) and triiodothyronine (T3) were evaluated at five different times during 140 and 175 days of treatment, respectively. Serum T4 levels

were significantly reduced at 0.09 and 0.43 mg/kg-day by day 35 and at greater than or equal to 0.61 mg/kg-day by day 14. T3 levels were significantly reduced at 0.09 mg/kg-day by day 40 and at greater than or equal to 0.4 mg/kg-day by day 20. The suppressions were generally dose-related for T4 throughout the treatment period and T3 after 75 days. Disappearance rate of injected L-[125I] T4 was significantly decreased at greater than or equal to 0.09 mg/kg-day. Rats treated with only 0.43 or 0.61 mg/kg-day for approximately 5 months and challenged with i.p. injected TSH had diminished response of serum T4 and T3. Thyroid histology was not evaluated. There were no treatment-related effects on relative thyroid weight, body weight or food consumption. The findings of this study indicate that the decreased serum T3 and T4 resulted primarily from direct damage to the thyroid rather than suppression of the hypothalamo-pituitary axis or any enhanced peripheral catabolism (e.g., liver). Insufficient data are available to determine if the decreases in circulating thyroid hormones were physiologically significant. However, because the effects are indicative of impaired organ function, they are at least potentially adverse and 0.09 mg/kg-day is considered to represent a LOAEL in rats.

Groups of 10 female Sprague-Dawley rats were fed 0, 1, 5, 10 or 50 ppm Aroclor 1254 in the diet for 5 months (Byrne et al., 1988). The Aroclor was dissolved in acetone which was evaporated from the diet prior to feeding. Using a rat food consumption factor of 0.05 kg food/kg body weight, the dosages are estimated to be 0.05, 0.25, 0.5 and 2.5 mg/kg-day. Serum levels of adrenal cortex hormones were evaluated in 8-10 rats 3-5 times during the treatment period. Serum corticosterone was significantly ( $p < 0.05$ ) decreased at greater than or equal to 0.25 mg/kg-day after approximately 60 days of exposure. Serum dehydroepiandrosterone and dehydroepiandrosterone sulfate were significantly ( $p < 0.05$ ) decreased at 0.25 and 0.5 mg/kg-day (not evaluated at other dosages) after approximately 100 days and 25 days of exposure, respectively. Serum corticosterone is the principal glucocorticoid in rats. Adrenal weight, adrenal histology and non-adrenal endpoints other than food consumption were not evaluated. Food consumption did not significantly differ between and among control and treatment groups. The results of this study are suggestive of toxicity to the adrenal rather than response to stress which would be expected to increase the release of glucocorticoids. Insufficient data are available to determine if the decreases in circulating adrenal cortex hormones were physiologically significant. However, because the effects are indicative of impaired organ function, they are at least potentially adverse. The dosages of 0.05 and 0.25 mg/kg-day therefore are considered to represent a NOEL and LOAEL, respectively, in rats.

Hepatotoxicity is a prominent effect of Aroclor 1254 that is well characterized in rats (U.S. EPA, 1990). The spectrum of effects includes hepatic microsomal enzyme induction, increased serum levels of liver-associated enzymes indicative of possible hepatocellular damage, liver enlargement, lipid deposition, fibrosis and necrosis. Estimated subchronic dosages as low as 1.25-2.5 mg/kg-day have been reported to produce increased liver weight and hepatic biochemical alterations in rats, but the lowest dosages producing signs of hepatic effects are generally higher than the lowest dosages that caused thyroid, adrenal and bone changes (Litterset et al., 1972; Bruckner et al., 1974; Kling and Gamble, 1982; Andrews et al., 1989). Rats fed 6.8 mg/kg-day for 8 months (Kimbrough et al., 1972) or an estimated dosage of 50 mg/kg-day for 30 days (Kling et al., 1978) developed fatty and necrotic degenerative hepatic histologic changes. Chronic dietary exposure to 1.25-5 mg/kg-day for approximately 2 years produced only preneoplastic and neoplastic liver lesions in rats (NCI, 1978; Ward, 1985).

A two-generation reproduction study was performed in which groups of 20 female and 10 male Sherman rats (age 3-4 weeks, body weight not reported) were fed 0, 1, 5, 20 or 100 ppm dietary Aroclor 1254 (Monsanto Lot No. AK-38) in peanut oil vehicle (Linder et al., 1974). Reported dosages were 0.06, 0.32, 1.5 and 7.6 mg/kg-day, and different controls were used for the less than or

equal to 0.32 and greater than or equal to 1.5 mg/kg-day groups. Exposure times (before mating or conception-to-mating) ranged from 62-274 days. Exposure-related effects included increased relative liver weight in F1a weanlings at greater than or equal to 0.06 mg/kg-day, enlarged and vacuolated hepatocytes in F2a weanlings at greater than or equal to 1.5 mg/kg-day, and 15-72% reduced litter size at greater than or equal to 1.5 mg/kg-day in the F1b, F2a and F2b generations and at 7.6 mg/kg-day in the F1a generation. Relative testes weights were increased in adult F1b males at 7.6 mg/kg-day (other groups not evaluated). The highest NOAEL is 0.32 mg/kg-day based on the increased liver weight without altered histology. The decreased litter size indicates that 1.5 mg/kg-day is a FEL.

A one-generation reproduction study was performed in which groups of 10 male and 10 female Sherman rats were fed 0, 100 or 500 ppm dietary Aroclor 1254 for 67 or 186 days prior to pair-mating for the F1a and F1b generations, respectively (Linder et al., 1974). The F0 rats received reported dosages of 0, 7.2 and 37.0 mg/kg-day and were sacrificed after a total exposure duration of 8 months for hematology, organ weight and liver histology evaluation. The study was terminated after the F1b pups were weaned. Effects in the P1 rats included increased liver weight in both sexes greater than or equal to 7.2 mg/kg-day, increased relative testis weight (absolute weight unchanged) at 37.0 mg/kg-day, decreased body weight gain in both sexes at 37.0 mg/kg-day, and changes in hematological values (reduced hematocrit and hemoglobin in both sexes, increased total leukocytes with normal differential count in females) at 37.0 mg/kg-day. Specific information on liver pathology was not reported but degenerative changes similar to those found in the Kimbrough et al. (1972) subchronic study were indicated for both dosages. Effects on the offspring included reduced survival to weaning at 7.2 mg/kg-day (85.9 and 68.1% survival in F1a and F1b pups, respectively, compared with 95.5% in controls), and reduced litter size and number and 100% pup mortality by day 3 in F1a rats at 37.0 mg/kg-day. The decreases in postnatal survival indicate that both dosages are FELs.

Groups of six to eleven female Wistar rats were fed 2.5, 26 or 269 ppm Aroclor 1254 in the diet during gestation and lactation (Overman et al., 1987). A control group was fed untreated diet that contained 0.02 ppm PCBs (i.e., no added PCBs). Using a rat food consumption factor of 0.05 kg food/kg body weight, the dosages are estimated to be 0.001, 0.13, 1.3 and 13.5 mg/kg-day. The following neurobehavioral endpoints were significantly delayed or reduced in the pups: appearance of the auditory startle response at 0.13 and 1.3 mg/kg-day at age 6 days (slightly delayed), development of righting ability at 1.3 mg/kg-day at days of age (slightly delayed) and performance on a motor coordination test at 1.3 mg/kg-day at age 7 and 8 days (slower performance). Grip strength and appearance of eye opening were not affected by exposure. Other effects attributable to exposure included increased relative liver weight in pups at weaning at greater than or equal to 1.3 mg/kg-day and reduced birth weight, 50% mortality by 2 days of age and retarded growth in pups at 13.5 mg/kg-day. There were no exposure-related effects on maternal weight gain, gestation length, litter size, pup sex ratios, number of live and dead pups or physical appearance, relative spleen and thymus weight or relative and absolute brain weight of pups. Brain PCB levels increased from birth to weaning in all groups. Based on the evidence for impaired motor coordination in developing infants the 0.13 and 1.3 mg/kg-day dosages are a NOAEL and LOAEL, respectively.

Dietary Aroclor 1254 was administered to groups of 4-10 female ICR mice in concentrations of 0, 1, 10 or 100 ppm from 90 days before mating through gestation day 18 (Welsch, 1985). The investigators estimated the dosages to be 0.125, 1.25 and 12.5 mg/kg-day. No developmental toxicity was observed as judged by number of litters, number of dead and reabsorbed fetuses, fetal weight, incidence of gross malformations or skeletal development. Fetuses were not examined for internal malformations. Maternal effects other than significantly increased relative liver weight at greater than or equal to

0.125 mg/kg-day were not observed. No developmental effects were observed in mice treated with the same doses of PCB only on gestation days 6-18. Based on the increased maternal liver weight the highest NOAEL is 12.5 mg/kg-day.

Groups of seven adult male New Zealand white rabbits were fed dietary Aroclor 1254 in reported estimated dosages of 0, 0.18, 0.92, 2.10 or 6.54 mg/kg-day for 8 weeks (Street and Sharma, 1975). Immunological testing was started after 4 weeks of treatment at which time the rabbits were immunized with injected SRBCs. No treatment-related changes in serum antibody titers to SRBC (hemolysin and hemagglutination) were observed. SRBC-induced increases in serum gamma-globulin were consistently but not statistically significantly decreased by exposure, and the number of globulin-producing cells in popliteal lymph nodes was significantly decreased at 0.92 and 6.54 mg/kg-day. Skin sensitivity to tuberculin was generally lower in the treated groups but none of the decreases were statistically significant. Marked histologic atrophy of the thymus cortex was observed at 0.18 mg/kg-day and higher dosages except 0.92 mg/kg-day. There were no treatment-related effects on leukocyte count, histology of the spleen, thymus, liver, kidneys or spleen, relative kidney or adrenal weight, terminal body weight or food consumption. Relative liver and spleen weights were significantly increased at greater than or equal to 2.10 mg/kg-day; the increase in liver weight was 74% at the highest dosage. The 0.18 mg/kg-day dosage is a LOAEL based on the thymic cortical atrophy.

Limited specific information is available on the oral absorption of Aroclor 1254. Pregnant ferrets that ingested a single oral dose of Aroclor 1254 (approximately 0.06 mg/kg) absorbed approximately 85% of the initial amount (Bleavins et al., 1984). Studies predominately of individual chlorobiphenyl congeners indicate, in general, that PCBs are readily and extensively absorbed by animals. These studies have found oral absorption efficiency on the order of 75 to >90% in rats, mice and monkeys (Albro and Fishbein, 1972; Allen et al., 1974; Tanabe et al., 1981; Clevenger et al., 1989). A study of a non-Aroclor 54% chlorine PCB mixture prepared by the investigators provides direct evidence of absorption of PCBs in humans after oral exposure (Buhler et al., 1988), and indirect evidence of oral absorption of PCBs by humans is available from studies of ingestion of contaminated fish by the general population (Schwartz et al., 1983; Kuwabara et al., 1979). There are no quantitative data regarding inhalation absorption of PCBs in humans but studies of workers exposed suggest that PCBs are well absorbed by the inhalation and dermal routes (Maroni et al., 1981a,b; Smith et al., 1982; Wolff, 1985). PCBs distribute preferentially to adipose tissue and concentrate in human breast milk due to its high fat content (Jacobson et al., 1984b; Ando et al., 1985).

The metabolism of PCBs following oral and parenteral administration in animals has been extensively studied and reviewed, but studies in animals following inhalation or dermal exposure are lacking (Sundstrom and Hutzinger, 1976; Safe, 1980; Sipes and Schnellmann, 1987). Information on metabolism of PCBs in humans is limited to occupationally exposed individuals whose intake is derived mainly from inhalation and dermal exposure (Jensen and Sundstrom, 1974; Wolff et al., 1982; Schnellmann et al., 1983; Safe et al., 1985; Fajt et al., 1989). In general, metabolism of PCBs depends on the number and position of the chlorine atoms on the phenyl ring of the constituent congeners (i.e., congener profile of the PCB mixture) and animal species. Although only limited data are available on metabolism of PCBs following inhalation exposure, there is no reason to suspect that PCBs are metabolized differently by this route.

Data exist on the in vitro hepatic metabolism and in vivo metabolic clearance of 2,2',3,3',6,6'-hexachlorobiphenyl and 4,4'-dichlorobiphenyl congeners in humans, monkeys, dogs and rats (Schnellmann et al., 1985). The hexachlorobiphenyl congener is a constituent of Aroclor 1254. For each congener, the Vmax values for metabolism in the monkey, dog and rat are consistent with the respective metabolic clearance values found in vivo.



Thus, the kinetic constants for PCB metabolism obtained from the dog, monkey and rat hepatic microsomal preparations were good predictors of in vivo metabolism and clearance for these congeners. In investigations directed at determining which species most accurately predicts the metabolism and disposition of PCBs in humans, the in vitro metabolism of these congeners was also studied using human liver microsomes (Schnellmann et al., 1983, 1984). Available data suggest that metabolism of PCBs in humans would most closely resemble that of the monkey and rat. For example, the in vitro apparent  $K_m$  and  $V_{max}$  are comparable between humans and monkeys. These studies show consistency between the in vitro and in vivo findings and collectively indicate that metabolism of the two congeners is similar in monkeys and humans.

#### I.A.5. CONFIDENCE IN THE ORAL RfD

Study -- Medium  
Data Base -- Medium  
RfD -- Medium

Confidence in the principal study is medium. Groups of 16 rhesus monkeys were tested at four dose levels and LOAEL was established on the basis of clinical signs and immunologic alterations. Data for female and male reproductive function and developmental data in a nonhuman primate species is taken from an unpublished study (Levinskas et al., 1984) which established a NOAEL for reproductive effects at 0.005 mg/kg-day. The Arnold study also included evaluation of reproductive function but the data have not been completely analyzed. Preliminary examination of the Arnold et al. data indicate that the LOAEL for female reproductive function may be 0.005 mg/kg-day. This inconsistency in effect levels for reproductive toxicity was viewed as a limitation to the data base. Furthermore, there is a limitation in the characterization of reproductive toxicology because results of an unpublished study have been considered. An extensive number of laboratory animal and human studies were available for review, including two-generation reproductive studies. The chronic, 2-year bioassays performed in F344 rats showed evidence of degenerative hepatocellular changes in addition to the neoplastic changes that were observed. Only limited assessment of nonhepatic changes were made. Human occupational and environmental data is available for commercial PCB mixtures in general but not specifically for Aroclor 1254. The data base is rated medium on the basis of these considerations. Overall confidence in the RfD is medium.

#### I.A.6. EPA DOCUMENTATION AND REVIEW OF THE ORAL RfD

Source Document -- This assessment is not presented in any existing U.S. EPA document.

Other EPA Documentation -- U.S. EPA, 1984, 1989, 1990

Agency Work Group Review -- 06/16/1993, 02/16/1994

Verification Date -- 02/16/1994

### **\_\_I.A.7. EPA CONTACTS (ORAL RfD)**

Please contact the IRIS Hotline for all questions concerning this assessment or IRIS, in general, at (301) 345-2870 (phone), (301) 345-2876 (FAX) or Hotline.IRIS@epamail.epa.gov (internet address).

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### **\_\_I.B. REFERENCE CONCENTRATION FOR CHRONIC INHALATION EXPOSURE (RfC)**

Substance Name -- Aroclor 1254  
CASRN -- 11097-69-1  
Primary Synonym -- PCBs, Polychlorinated Biphenyls

Not available at this time.

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## **\_\_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE**

Substance Name -- Aroclor 1254  
CASRN -- 11097-69-1  
Primary Synonym -- PCBs, Polychlorinated Biphenyls

This substance/agent has not undergone a complete evaluation and determination under US EPA's IRIS program for evidence of human carcinogenic potential.

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## **\_\_VI. BIBLIOGRAPHY**

Substance Name -- Aroclor 1254  
CASRN -- 11097-69-1  
Primary Synonym -- PCBs, Polychlorinated Biphenyls  
Last Revised -- 10/01/1994

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## VI.B. INHALATION RfC REFERENCES

None

## VI.C. CARCINOGENICITY ASSESSMENT REFERENCES



None

## **\_VII. REVISION HISTORY**

Substance Name -- Aroclor 1254  
CASRN -- 11097-69-1  
Primary Synonym -- PCBs, Polychlorinated Biphenyls

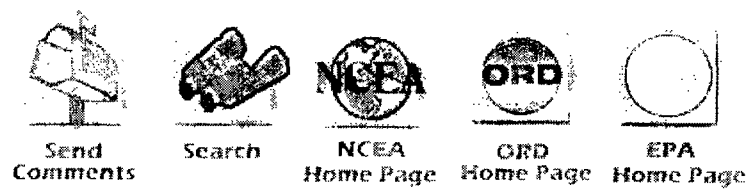
Date	Section	Description
07/01/1993	I.A.	Oral RfD now under review
09/01/1993	All	Minor edit
03/01/1994	I.A.	Work group review date added
10/01/1994	I.A.	Oral RfD summary on-line
10/01/1994	VI.A.	Oral RfD references on-line
11/01/1996	I.A.7.	Primary contact's office changed
04/01/1997	III., IV., V.	Drinking Water Health Advisories, EPA Regulatory Actions, Supplementary Data were removed from IRIS on or before April 1997. IRIS users were directed to the appropriate EPA Program Offices for this information.

## **VIII. SYNONYMS**

Substance Name -- Aroclor 1254  
CASRN -- 11097-69-1  
Primary Synonym -- PCBs, Polychlorinated Biphenyls  
Last Revised -- 07/01/1993

11097-69-1  
Aroclor 1254  
Arochlor 1254  
CHLORIERTE BIPHENYLE, CHLORGEHALT 54% [German]  
CLORODIFENILI, CLORO 54% [Italian]  
DIPHENYLE CHLORE, 54% DE CHLORE [French]  
HSDB 6357  
NCI-C02664





Last updated: 5 May 1998  
URL: <http://www.epa.gov/iris/subst/0389.htm>

**Attachment H**  
**IRIS information for Aroclor 1254**



## Aroclor 1254

CASRN 11097-69-1

### Contents

- I.A. REFERENCE DOSE FOR CHRONIC ORAL EXPOSURE (RfD)
- I.B. REFERENCE CONCENTRATION FOR CHRONIC  
INHALATION EXPOSURE (RfC)
- II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE
- VI. BIBLIOGRAPHY
- VII. REVISION HISTORY
- VIII. SYNONYMS

0389

Aroclor 1254; CASRN 11097-69-1

Health assessment information on a chemical substance is included in IRIS only after a comprehensive review of chronic toxicity data by U.S. EPA health scientists from several Program Offices and the Office of Research and Development. The summaries presented in Sections I and II represent a consensus reached in the review process. Background information and explanations of the methods used to derive the values given in IRIS are provided in the Background Documents.

STATUS OF DATA FOR Aroclor 1254

File On-Line 10/01/1994

Category (section)	Status	Last Revised
Oral RfD Assessment (I.A.)	on-line	11/01/1996
Inhalation RfC Assessment (I.B.)	no data	
Carcinogenicity Assessment (II.)	no data	

## **I. CHRONIC HEALTH HAZARD ASSESSMENTS FOR NONCARCINOGENIC EFFECTS**

### **I.A. REFERENCE DOSE FOR CHRONIC ORAL EXPOSURE (RfD)**

Substance Name -- Aroclor 1254  
 CASRN -- 11097-69-1  
 Primary Synonym -- PCBs, Polychlorinated Biphenyls  
 Last Revised -- 11/01/1996

The oral Reference Dose (RfD) is based on the assumption that thresholds exist for certain toxic effects such as cellular necrosis. It is expressed in units of mg/kg-day. In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. Please refer to the Background Document for an elaboration of these concepts. RfDs can also be derived for the noncarcinogenic health effects of substances that are also carcinogens. Therefore, it is essential to refer to other sources of information concerning the carcinogenicity of this substance. If the U.S. EPA has evaluated this substance for potential human carcinogenicity, a summary of that evaluation will be contained in Section II of this file.

#### **I.A.1. ORAL RfD SUMMARY**

Critical Effect	Experimental Doses*	UF	MF	RfD
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Ocular exudate, inflamed and prominent Meibomian glands, distorted growth of finger and toe nails; decreased antibody (IgG and IgM) response to sheep erythrocytes	NOAEL: None LOAEL: 0.005 mg/kg-day	300	1	2E-5 mg/kg-day
Monkey Clinical and Immunologic Studies				
Arnold et al., 1994a,b; Tryphonas et al., 1989, 1991a,b				
*Conversion Factors and Assumptions -- None				

## I.A.2. PRINCIPAL AND SUPPORTING STUDIES (ORAL RfD)

Arnold, D.L., F. Bryce, R. Stapley et al. 1993a. Toxicological consequences of Aroclor 1254 ingestion by female Rhesus (*Macaca mulatta*) monkeys, Part 1A: Prebreeding phase - clinical health findings. *Food Chem. Toxicol.* 31: 799-810.

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Tryphonas, H., S. Hayward, L. O'Grady et al. 1989. Immunotoxicity studies of PCB (Aroclor 1254) in the adult rhesus (*Macaca mulatta*) monkey -- preliminary report. *Int. J. Immunopharmacol.* 11: 199-206.

Tryphonas, H., M.I. Luster, G. Schiffman et al. 1991a. Effect of chronic exposure of PCB (Aroclor 1254) on specific and nonspecific immune parameters in the rhesus (*Macaca mulatta*) monkey. *Fund. Appl. Toxicol.* 16(4): 773-786.

Tryphonas, H., M.I. Luster, K.L. White et al. 1991b. Effects of PCB (Aroclor 1254) on non-specific immune parameters in Rhesus (*Macaca mulatta*) monkeys. *Int. J. Immunopharmacol.* 13: 639-648.

Groups of 16 adult female rhesus monkeys ingested gelatin capsules containing Aroclor 1254 (Monsanto Lot No. KA634) in 1:1 glycerol: corn oil vehicle daily at dosages of 0, 5, 20, 40 or 80 ug/kg-day for more than 5 years. The Aroclor mixture contained 5.19 ppm of polychlorinated dibenzofurans and undetectable levels of polychlorinated dibenzo-p-dioxins (Truelove et al., 1990). At study initiation the monkeys were 11.1 +/- 4.1 years old (Tryphonas et al., 1991a,b; Arnold et al., 1993a,b). After 25 months of exposure the monkeys had achieved a pharmacokinetic steady-state based on PCB concentrations in adipose tissue and/or blood (Tryphonas et al., 1989). Results of general health and clinical pathology evaluations conducted during the first 37 months of exposure were reported by Arnold et al. (1993a,b). Results of immunologic assessments after 23 and 55 months of exposure were reported by Tryphonas et al. (1989, 1991a,b). Results of reproductive endocrinology evaluations after 24 or 29 months of exposure were reported by Truelove et al. (1990) and Arnold et al. (1993a). Effects on hydrocortisone levels during the first 22 months of exposure were reported by Loo et al. (1989) and Arnold et al. (1993b). All of the aforementioned evaluations were performed during the prebreeding phase of the study. Results of reproduction and histopathology evaluations in these monkeys are not fully available (Arnold, 1992).

General health status was evaluated daily, and body weight measurements, feed conversion ratio calculations, and detailed clinical evaluations were performed weekly throughout the study. Analyses of clinical signs of toxicity were limited to the occurrence of eye exudate, inflammation and/or prominence of the eyelid Meibomian (tarsal) glands, and particular changes in finger and toe nails (prominent nail beds, separation from nail beds, elevated nail beds, and nails folding on themselves). Each endpoint was analyzed for individual treatment-control group differences and dose-related trends with respect to incidence rate, total frequency of observed occurrences, and the onset time of the condition. With respect to effects on the eyes, the treatment-control group comparisons showed statistically significant (p less than or equal to 0.05) increases in the total frequency of inflamed and/or prominent Meibomian glands at 0.005, 0.02 and 0.08 mg/kg-day, and decreased onset time for these effects at 0.08 mg/kg-day. Significant dose-related trends (p less than or equal to 0.05) were observed for increased total frequencies of inflamed and/or prominent Meibomian glands, decreased onset time of inflamed and/or

prominent Meibomian glands, and increased incidences of eye exudate. With respect to effects on finger and/or toe nails, the treatment-control group comparisons showed significantly ( $p$  less than or equal to 0.05) increased incidence of certain nail changes at 0.005 mg/kg-day (nail folding) and 0.08 mg/kg-day (elevated nails), increased total frequency of certain nail changes at 0.005 mg/kg-day (nail separation), 0.04 mg/kg-day (nail folding and separation) and 0.08 mg/kg-day (nail folding and separation, prominent beds, elevated nails), and decreased onset time of certain nail changes at 0.005 mg/kg-day (elevated nails) and 0.08 mg/kg-day (nail folding, prominent beds, elevated nails). Significant dose-related trends ( $p$  less than or equal to 0.05) were observed for certain nail changes (prominent beds, elevated nails) when adjusted for onset time, total frequencies of certain nail changes (nail folding and separation, prominent beds, elevated nails), and decreases in onset time of certain nail changes (nail folding, prominent beds, elevated nails).

Immunologic assessment showed significant ( $p < 0.01$  or  $< 0.05$ ) reductions in IgG (at all doses of Aroclor 1254) and IgM (all doses but 0.02 mg/kg-day) antibody levels in response to injected sheep red blood cells (SRBC) after 23 months of exposure (Tryphonas et al., 1989). A significant ( $p < 0.05$ ) decrease in the percent of helper T-lymphocytes, a significant ( $p < 0.05$ ) increase in the percent and absolute level of suppressor T-lymphocytes (TS) and a significant ( $p < 0.01$ ) reduction in TH/TS ratio was observed at 0.08 mg/kg-day. The antibody response to SRBC is an antigen-driven response that requires the interaction of several distinct cell types (i.e., antigen processing and presentation by macrophages, participation by T-helper cells and finally proliferation and differentiation of B cells into plasma cells that secrete the antibody), which result in the production and secretion of antibodies specific for SRBC from plasma cells. Perturbation in any of the cells or cell-to-cell interactions by physical, chemical or biological agents can result in aberrant antibody responses. The necessity for the interaction of the three principal cells of the immune system (i.e., macrophage, B lymphocyte and T lymphocyte), in response to SRBC, is the main reason why this response has been so widely used in immunotoxicity testing as a surrogate for infection with a pathogenic organism.

In a recent evaluation of the sensitivity and predictability of various immune function assays used for immunotoxicity testing in the mouse (Luster et al., 1992), the antibody plaque-forming cell (PFC) response to SRBC was found to show the highest association with immunotoxic compounds. Essentially this means that the antibody PFC response to SRBC is a very good predictor of immunotoxicants. Also, it has recently been demonstrated that measurement of serum antibody titer to SRBC using the ELISA assay is as sensitive as the PFC assay for determining the response to SRBC (Butterworth et al., 1993).

There were no exposure-related effects on total B-lymphocytes, total T-lymphocytes, total serum immunoglobulin levels, total serum protein, serum protein fractions after 23 months. No exposure-related effects on serum hydrocortisone levels were observed although the SRBC assay is considered a good surrogate (Tryphonas et al., 1989; Loo et al., 1989; Arnold et al., 1993b).

After 55 months of exposure, there was a significant dose-related decrease ( $p < 0.0005$  for pairwise comparisons and trend test) in the IgM antibody response to injected SRBC at greater than or equal to 0.005 mg/kg-day at all times of evaluation (1-4 weeks postimmunization) (Tryphonas et al., 1991a). IgG antibody response to injected SRBC was significantly ( $p < 0.01$ ) decreased only at 0.04 mg/kg-day, although the overall trend for dose-response was significant ( $p = 0.033$ ). The antibody response to pneumococcus antigen did not differ significantly among all test groups (including controls) at any time tested and showed no dose-related trend. However, the antibody response to pneumococcus antigen is a T cell-independent response and the fact that there is no change with this antigen is not inconsistent with the depressed response

to the T cell-dependent SRBC antigen. Other data corroborate the significance of Aroclor 1254 suppression of the antibody response to SRBC and point to effects on T lymphocytes including the dose-related suppression of the Con A and PHA lymphoproliferative responses. The monkeys treated with greater than or equal to 0.005 mg/kg-day had significantly ( $p < 0.0001$ ) lower mean percentage levels of total T-lymphocytes and significant trend for dose-response, but absolute numbers of T-lymphocytes were similar among test groups. Flow cytometric analysis showed no treatment-related effects on peripheral blood T-helper, T-suppressor or B-lymphocytes or TH/TS lymphocyte ratio. A statistically significant, dose-related increase was noted for thymosin alpha-1-levels but not for thymosin beta-2-levels. Serum complement activity was significantly ( $p < 0.025$ ) increased at greater than or equal to 0.005 mg/kg-day but showed no significant ( $p = 0.1$ ) dose-related trend. Natural killer cell activity at effect or target ratios of 25:1, 50:1 or 75:1 was not significantly ( $p > 0.05$ ) increased at any dosage, although there was a significant ( $p = 0.03$ ) dose-related trend. No signs of microbial infection were noted in any of the preceding reports.

Clinical pathology was evaluated during the first 37 months of the study (Arnold et al., 1993b). These evaluations included monthly measurements of hematology and serum biochemistry (including serum protein, RBC indices, semi-monthly measurements of thyroid function, and daily measurements of urinary porphyrins during the 33rd month of dosing). Significant ( $p \leq 0.05$ ) decreases in average dose-group values compared with controls were found for serum cholesterol at 0.04 mg/kg-day, and reticulocyte count, serum cholesterol, total bilirubin, and alpha-1 + alpha-2-globulins at 0.08 mg/kg-day. Significant dose-related decreasing linear trends were also observed for reticulocyte count ( $p = 0.002$ ), cholesterol ( $p$  less than or equal to 0.001), and total bilirubin ( $p = 0.005$ ). Dose-related decreasing linear trends were also observed for red blood cell count ( $p = 0.019$ ), mean platelet volume ( $p = 0.034$ ), hematocrit ( $p = 0.064$ ), hemoglobin concentration ( $p = 0.041$ ). With regard to thyroid endpoints [serum thyroxine (T4), serum triiodothyronine (T3) uptake ratio, percent T3 uptake, and free thyroxine index], dose-response analysis consisted of group mean comparisons and an assessment of parallelism in the response profiles (an absence of parallelism would indicate time-dose interactive effects). No statistically significant changes were observed for any of the thyroid endpoints.

After approximately 2 years of dosing, each dose group was randomly divided into two test groups for daily analyses of serum progesterone and estrogen concentrations during one menstrual cycle (Truelove et al., 1990; Arnold et al., 1993b). There were no statistically significant differences between treated and control monkeys in menstrual cycle length or menses duration, and no apparent treatment-related effects on incidence of anovulatory cycles or temporal relationship between estrogen peak and menses onset, menses end or progesterone peak (Truelove et al., 1990; Arnold et al., 1993a,b).

To summarize the above, monkeys that ingested 0.005-0.08 mg/kg-day doses of Aroclor 1254 showed ocular exudate, prominence and inflammation of the Meibomian glands and distortion in nail bed formation. These changes were seen at the lowest dose tested, 0.005 mg/kg-day, and a dose-dependent response was demonstrated. Similar changes have been documented in humans for accidental oral ingestion of PCBs. Among the various immunologic function tests that were performed, the increases in IgM and IgG antibodies to sheep erythrocytes are most significant. IgG and IgM antibodies in response to SRBC were reduced after 23 months of exposure but only the IgM antibodies were clearly decreased after 55 months. Particular importance is attributed to the immune response to sheep erythrocytes since it involves participation by the three principal cells of the immune system: the macrophage, B lymphocytes and T lymphocytes and has been shown to be the most predictive immunotoxicity test of those currently in use (Luster et al., 1992). On the basis the studies described, a LOAEL of 0.005 mg/kg-day was established for Aroclor 1254.



### I.A.3. UNCERTAINTY AND MODIFYING FACTORS (ORAL RfD)

UF -- A 10-fold factor is applied to account for sensitive individuals. A factor of 3 is applied to extrapolation from rhesus monkeys to humans. A full 10-fold factor for interspecies extrapolation is not considered necessary because of similarities in toxic responses and metabolism of PCBs between monkeys and humans and the general physiologic similarity between these species. A partial factor is applied for the use of a minimal LOAEL since the changes in the periocular tissues and nail bed seen at the 0.05 mg/kg-day are not considered to be of marked severity. The duration of the critical study continued for approximately 25% of the lifespan of rhesus monkeys so that a reduced factor was used for extrapolation from subchronic exposure to a chronic RfD. The immunologic and clinical changes that were observed did not appear to be dependent upon duration which further justifies using a factor of 3 rather than 10 for extrapolation from subchronic to chronic, lifetime exposure. The total UF is 300.

MF -- None

### I.A.4. ADDITIONAL STUDIES / COMMENTS (ORAL RfD)

Human data available for risk assessment of Aroclor 1254 are useful only in a qualitative manner. Studies of the general population who were exposed to PCBs by consumption of contaminated food, particularly neurobehavioral evaluations of infants exposed in utero and/or through lactation, have been reported, but the original PCB mixtures, exposure levels and other details of exposure are not known (Kreiss et al., 1981; Humphrey, 1983; Fein et al., 1984a,b; Jacobson et al., 1984a, 1985, 1990a,b; Rogan et al., 1986; Gladen et al., 1988). Most of the information on health effects of PCB mixtures in humans is available from studies of occupational exposure. Some of these studies examined workers who had some occupational exposure to Aroclor 1254, but sequential or concurrent exposure to other Aroclor mixtures nearly always occurred, exposure involved dermal as well as inhalation routes (relative contribution by each route not known), and monitoring data are lacking or inadequate (Alvares et al., 1977; Brown and Jones, 1981; Colombi et al., 1982; Fischbein et al., 1979, 1982, 1985; Fischbein, 1985; Warshaw et al., 1979; Smith et al., 1982; Taylor et al., 1984; Lawton et al., 1985). Insufficient data are available in these studies to determine possible contributions of Aroclor 1254 alone, extent of direct skin exposure and possible contaminants. However, it is relevant to note that dermal and ocular effects, including skin irritation, chloracne, hyperpigmentation and eyelid and conjunctival irritation, have been observed in humans occupationally exposed to Aroclor 1254 and other Aroclor formulations.

Aroclor 1254 was fed to groups of eight female and four male adult rhesus monkeys once daily in dosages of 0, 5, 25 or 100 ug/kg for 14 months, followed by an observation period of 7 months (Levinskas et al., 1984). The Aroclor 1254 was dissolved in corn oil and offered to the animals in apple sauce prior to each day's feeding, and the control mixture (corn oil in applesauce) was used during the observation period. Dosages were adjusted biweekly for changing body weight as necessary. The monkeys were selected on the basis of a successful reproductive history, estimated to be at least 6 years old, and had been in captivity for 2-9 years. After 6 months of treatment the monkeys

were bred to untreated males or females from the same colony over an 8-month period and offspring were observed for 2 months. Breeding was continued until conception was diagnosed by digital examination of the uterus and alterations in the menstrual cycle. Evaluations of adult animals included hematology and clinical chemistry. Urinalysis was also performed every 3 months during the study. Semen analyses were performed monthly from just prior to the start of treatment until the end of the treatment period. After 2 months of observation; sperm concentration, total sperm, sperm motility, percent abnormal cells and live/dead ratios were evaluated. Based upon these parameters, no effect was observed upon male reproductive capacity. Necropsies including histological examinations were performed on all adult animals that died during the study or were euthanized at the end of the observation period. Birth weight and somatic measurements were taken for all offspring of exposed females or males. The infants of the exposed females were subsequently evaluated monthly for body weight and complete blood cell counts were performed. Infants that did not show signs of intoxication were euthanized after 2 months and those showing signs were weaned, observed for reversal of signs, and euthanized at the end of the study along with the adults. Necropsies including histological examinations were performed on all infants that died or were euthanized.

Death or euthanasia in extremis occurred in 1/12, 0/12, 1/12 and 5/12 of the adult monkeys in the control, low-, mid- and high-dose groups, respectively. All of the deaths occurred in females except for one male in the high-dose group, and the only deaths considered to be related to treatment were in four of the high-dose animals (3 females, 1 male). Characteristic signs of PCB intoxication developed in the high-dose group after 9 months of exposure, including effects on the eyelids (redness and/or edema, wrinkling) in approximately half the animals and swelling of the lips in all animals. Other characteristic signs included bleeding gums, abnormal fingernail/toenail growth pattern and increased alopecia (including eyelashes) in several of the high-dose monkeys. In general, the signs of intoxication appeared to subside during the post-treatment period. Some of the monkeys in the mid-dose group showed signs of intoxication (swelling of the lips in one male and one female) after 15 and 18 months, respectively, and alopecia and abnormal nail growth, but no signs attributable to exposure occurred in the low-dose group. Hematologic effects at the high dose were observed including reduced packed cell volume, erythrocyte count, hemoglobin and platelet counts. In addition, increased serum iron and reduced serum cholesterol were observed, particularly in the monkeys that died. Some of the high-dose monkeys also had prolonged bleeding and improper healing at biopsy sites. Dermal histological changes characteristic of PCB poisoning were prominent in the high-dose group, occurring in 11/12 monkeys (8 females, 3 males), and included loss of secretory epithelium in the Meibomian (eyelid) glands and sebaceous glands, partial or total atrophy of sebaceous glands, follicular keratosis and/or squamous cysts. Dermal changes also occurred in four of the mid-dose monkeys, but not in the low-dose or control groups. Other histological alterations included squamous metaplasia in glandular ducts of the tongue or lip (3 high-dose females, 1 high-dose male), subgingival epithelial cysts of the mandible (1 high-dose male, 1 high-dose female, 1 mid-dose male) and hyperplasia in the bile and pancreatic ducts and gall bladder (1 high-dose female). Nonspecific bone marrow alterations (decreased cellularity and/or granulocyte maturation) occurred in 6/12 high-dose monkeys (5 females, 1 male) and may have been compound-related because they correlated with the hematologic changes.

There was no apparent effect on male fertility based on conception rate following matings with the untreated females or the semen analyses (Levinskas et al., 1984). In the female control, low-, mid- and high-dose groups, the numbers of known pregnancies were 7, 7, 7 and 5, respectively, the numbers of live births were 6, 5, 7 and 1, respectively. Analysis of the preceding data showed that there was a statistically significant reduction in fertility in the high-dose group; this analysis refers only to the decreased number of live births. There was a clear exposure-related effect on birth weight and infant

body weight gain. When compared with control group infants (mean birth weight 495.2 g) the 0.025 mg/kg-day infants (mean birth weight 392.2 g) showed a statistically significant reduction in birth weight ( $p < 0.005$ ). Most of the infants in the mid-dose group and all of the infants in the high-dose had abnormal clinical signs. These changes included being born with or developed dermal signs that were consistent with those in the adults (e.g., swollen lips, swollen eyelids and/or scanty eyelashes) and more severe at the high dose, and also developed pulmonary signs (e.g., respiratory wheezing). Histological changes in the infants were generally similar to those observed in the adults. These effects included changes in the Meibomian and sebaceous glands, pancreatic ducts and bone marrow. Other histological changes included thymic atrophy in one mid-dose and the high-dose infant, and other effects in the high-dose infant (e.g., retarded kidney cortical maturation, bile duct hyperplasia and gastric mucosal gland cysts).

To summarize the above, no treatment-related effects were observed in the low-dose adults or their infants, indicating that 0.005 mg/kg-day is a NOAEL. For the mid-dose infants there was a 15% reduction in birth weight of infants that was statistically significant ( $p < 0.005$ ). When these infants reached 2 months of age the reduced body weight was 22% below controls and this difference was also found to be statistically significant ( $p = 0.05$ ). Ocular and dermal signs and/or histological changes characteristic of PCB intoxication developed in a some adults receiving 25 and 100 ug/kg-day, as well as in most of the infants in these groups. Based on these effects the 0.025 mg/kg-day dosage is a LOAEL. Other effects at the high dose included decreased adult survival, female fertility and numbers of live births, indicating that 0.1 mg/kg-day is a FEL. This FEL is supported by results of the Truelove study (Truelove et al., 1982).

Aroclor 1254 was fed to 1, 2 or 1 pregnant rhesus monkeys in reported average daily doses of 0, 0.1 or 0.2 mg/kg-day, respectively, 3 days/week for up to 267 days starting on gestation day 60 (Truelove et al., 1982). The exposure period included gestation and lactation. One of the adult monkeys in the low-dose group and the one adult in the high-dose group lost their fingernails after 233 and 242 days of PCB treatment, but other overt signs of intoxication were not observed. There was a significant reduction in antibody production in response to injected SRBC in the exposed monkeys, but levels of antibody production to tetanus toxoid were not appreciably different from control. The two low-dosage monkeys delivered dead infants. The infant of the high-dosage monkey died at age 139 days; this infant showed impaired immune function as assessed by antibody production following SRBC injections. Hematological evaluation performed bimonthly following parturition in adults and the surviving infant were inconclusive. Although evaluation of the dead infants and other results of this study is complicated by the small number of animals, the characteristic dermal sign of PCB toxicity in the exposed monkeys and lack of effects in controls strongly indicate that the developmental toxicity is exposure-related. Therefore, based on the stillbirths, 0.1 mg/kg-day is a FEL in monkeys.

Groups of four young adult female rhesus monkeys were fed 0 or 0.28 mg/kg doses of Aroclor 1254 for 5 days/week for 114-121 weeks (Tryphonas et al., 1986a,b; Arnold et al., 1990). Groups of four mature adult female cynomolgus monkeys that had a poor breeding history were similarly exposed for 55-58 weeks (Tryphonas et al., 1986a; Arnold et al., 1990). The Aroclor mixture contained no detectable polychlorinated dibenzo-p-dioxin contaminants. Adjusting for the partial weekly exposure gives an average daily dosage of 0.2 mg/kg-day. Prominent clinical signs appeared in all exposed rhesus monkeys during the first 2-12 months of exposure, including facial and periorbital edema, loss of eyelashes, Meibomian gland enlargement and impaction, conjunctivitis, nail lesions progressing from dryness to detachment and gingival hyperplasia and necrosis of varying severity. Two of the exposed rhesus monkeys developed overwhelming infections of the eye or periodontal tissue after 27 months of exposure prompting sacrifice within 48 hours. The

hematology and serum biochemistry evaluations showed various changes in the exposed rhesus monkeys, particularly slight or moderate normocytic anemia, depressed erythropoiesis in bone marrow and increased triglycerides and SGOT. The immunologic testing was inconclusive due to large interspecies variability. Pathology findings in the exposed rhesus monkeys included effects in the liver of three monkeys (30-55% increased relative liver weight, hepatocellular hypertrophy and necrosis, bile duct epithelial hypertrophy and hyperplasia, gall bladder epithelial hypertrophy), thyroid of two monkeys (enlargement, occasional follicular cell desquamation) and stomach of two monkeys (hypertrophic gastropathy). The cynomolgus monkeys had effects that were generally consistent with but less extensive and severe than those observed in the rhesus monkeys. After 38 weeks of exposure the rhesus monkeys were mated with untreated males; cynomolgus monkeys were not mated. The control and exposed rhesus monkeys became pregnant within 7 and 8 matings, respectively. Following extended post-implant bleeding all of the treated rhesus monkeys aborted within 30-60 days of gestation. Following recovery from the abortions the monkeys were bred again up to a maximum of seven times but none appeared to conceive. The menstrual cycle lengths and durations became erratic and longer during and subsequent to the breeding. Based on the abortions, reproductive impairment and pronounced overt signs of toxicity, the 0.2 mg/kg-day dosage is an FEL in monkeys.

Aulerich and Ringer (1977) performed a breeding study in which groups of eight female and two male adult mink were fed diets containing 0 or 2 ppm Aroclor 1254 for 39 weeks or until the kits were 4 weeks of age. The Aroclor was dissolved in acetone which was evaporated from the diet prior to feeding. Using assumed values of 150 g/day for food consumption and 0.8 kg for body weight for female mink (Bleavins et al., 1980), the estimated dosage of Aroclor 1254 is 0.4 mg/kg-day. Approximately monthly determinations reportedly showed no statistically significant ( $p < 0.05$ ) differences between the control and treated mink in body weight gain, hemoglobin, and hematocrit. Only two of seven mated females gave birth, producing one infant each. Of the two infants, one was born dead and the other had low body weight and was dead by age 4 weeks. Based on the reproductive and/or fetal toxicity resulting in nearly complete lack of births, 0.4 mg/kg-day is a FEL for Aroclor 1254 in mink.

Twelve female and four male adult ranch-bred mink (age 8 months, body weight not reported) were fed a diet containing 1 ppm Aroclor 1254 for 6 months (Wren et al., 1987a,b). Groups of 15 females and five males were used for unexposed controls. The mink were bred after approximately 12-14 weeks of exposure and exposure was continued until weaning at age 5 weeks. Using assumed values for food consumption and for body weight for female mink (Bleavins et al., 1980), the estimated dosage of Aroclor 1254 is 0.15 mg/kg-day. Offspring mortality during the first week of life was 75.8% higher in the exposed group than in the controls. Average body weight was significantly lower in the exposed offspring at age 3 and 5 weeks, but not at age 1 week, suggesting that transfer of PCBs by lactation may have contributed to the effect. There were no exposure-related effects on adult survival or mating performance, number of offspring per female mated or female that delivered, adult thyroid plasma T3 or T4 levels during the exposure period, adult scrotal diameter, offspring survival or relative liver weight at weaning or organ weights or histology (brain, kidney, adrenal, pituitary, thyroid). Teratogenicity was not evaluated. The neonatal mortality indicates that 0.15 mg/kg-day is an FEL in mink.

Groups of 10 female Sprague-Dawley rats were fed 0, 1, 5, 10 or 50 ppm Aroclor 1254 in the diet for approximately 5-6 months (Byrne et al., 1987). The Aroclor was dissolved in acetone which was evaporated from the diet prior to feeding. Based on reported body weight and food consumption data the dosages are estimated to be 0.09, 0.43, 0.61 and 4.3 mg/kg-day. Serum thyroxine (T4) and triiodothyronine (T3) were evaluated at five different times during 140 and 175 days of treatment, respectively. Serum T4 levels

were significantly reduced at 0.09 and 0.43 mg/kg-day by day 35 and at greater than or equal to 0.61 mg/kg-day by day 14. T3 levels were significantly reduced at 0.09 mg/kg-day by day 40 and at greater than or equal to 0.4 mg/kg-day by day 20. The suppressions were generally dose-related for T4 throughout the treatment period and T3 after 75 days. Disappearance rate of injected L-[125I] T4 was significantly decreased at greater than or equal to 0.09 mg/kg-day. Rats treated with only 0.43 or 0.61 mg/kg-day for approximately 5 months and challenged with i.p. injected TSH had diminished response of serum T4 and T3. Thyroid histology was not evaluated. There were no treatment-related effects on relative thyroid weight, body weight or food consumption. The findings of this study indicate that the decreased serum T3 and T4 resulted primarily from direct damage to the thyroid rather than suppression of the hypothalamo-pituitary axis or any enhanced peripheral catabolism (e.g., liver). Insufficient data are available to determine if the decreases in circulating thyroid hormones were physiologically significant. However, because the effects are indicative of impaired organ function, they are at least potentially adverse and 0.09 mg/kg-day is considered to represent a LOAEL in rats.

Groups of 10 female Sprague-Dawley rats were fed 0, 1, 5, 10 or 50 ppm Aroclor 1254 in the diet for 5 months (Byrne et al., 1988). The Aroclor was dissolved in acetone which was evaporated from the diet prior to feeding. Using a rat food consumption factor of 0.05 kg food/kg body weight, the dosages are estimated to be 0.05, 0.25, 0.5 and 2.5 mg/kg-day. Serum levels of adrenal cortex hormones were evaluated in 8-10 rats 3-5 times during the treatment period. Serum corticosterone was significantly ( $p < 0.05$ ) decreased at greater than or equal to 0.25 mg/kg-day after approximately 60 days of exposure. Serum dehydroepiandrosterone and dehydroepiandrosterone sulfate were significantly ( $p < 0.05$ ) decreased at 0.25 and 0.5 mg/kg-day (not evaluated at other dosages) after approximately 100 days and 25 days of exposure, respectively. Serum corticosterone is the principal glucocorticoid in rats. Adrenal weight, adrenal histology and non-adrenal endpoints other than food consumption were not evaluated. Food consumption did not significantly differ between and among control and treatment groups. The results of this study are suggestive of toxicity to the adrenal rather than response to stress which would be expected to increase the release of glucocorticoids. Insufficient data are available to determine if the decreases in circulating adrenal cortex hormones were physiologically significant. However, because the effects are indicative of impaired organ function, they are at least potentially adverse. The dosages of 0.05 and 0.25 mg/kg-day therefore are considered to represent a NOEL and LOAEL, respectively, in rats.

Hepatotoxicity is a prominent effect of Aroclor 1254 that is well characterized in rats (U.S. EPA, 1990). The spectrum of effects includes hepatic microsomal enzyme induction, increased serum levels of liver-associated enzymes indicative of possible hepatocellular damage, liver enlargement, lipid deposition, fibrosis and necrosis. Estimated subchronic dosages as low as 1.25-2.5 mg/kg-day have been reported to produce increased liver weight and hepatic biochemical alterations in rats, but the lowest dosages producing signs of hepatic effects are generally higher than the lowest dosages that caused thyroid, adrenal and bone changes (Litterset et al., 1972; Bruckner et al., 1974; Kling and Gamble, 1982; Andrews et al., 1989). Rats fed 6.8 mg/kg-day for 8 months (Kimbrough et al., 1972) or an estimated dosage of 50 mg/kg-day for 30 days (Kling et al., 1978) developed fatty and necrotic degenerative hepatic histologic changes. Chronic dietary exposure to 1.25-5 mg/kg-day for approximately 2 years produced only preneoplastic and neoplastic liver lesions in rats (NCI, 1978; Ward, 1985).

A two-generation reproduction study was performed in which groups of 20 female and 10 male Sherman rats (age 3-4 weeks, body weight not reported) were fed 0, 1, 5, 20 or 100 ppm dietary Aroclor 1254 (Monsanto Lot No. AK-38) in peanut oil vehicle (Linder et al., 1974). Reported dosages were 0.06, 0.32, 1.5 and 7.6 mg/kg-day, and different controls were used for the less than or

equal to 0.32 and greater than or equal to 1.5 mg/kg-day groups. Exposure times (before mating or conception-to-mating) ranged from 62-274 days. Exposure-related effects included increased relative liver weight in Fl<sub>a</sub> weanlings at greater than or equal to 0.06 mg/kg-day, enlarged and vacuolated hepatocytes in F2<sub>a</sub> weanlings at greater than or equal to 1.5 mg/kg-day, and 15-72% reduced litter size at greater than or equal to 1.5 mg/kg-day in the Fl<sub>b</sub>, F2<sub>a</sub> and F2<sub>b</sub> generations and at 7.6 mg/kg-day in the Fl<sub>a</sub> generation. Relative testes weights were increased in adult Fl<sub>b</sub> males at 7.6 mg/kg-day (other groups not evaluated). The highest NOAEL is 0.32 mg/kg-day based on the increased liver weight without altered histology. The decreased litter size indicates that 1.5 mg/kg-day is a FEL.

A one-generation reproduction study was performed in which groups of 10 male and 10 female Sherman rats were fed 0, 100 or 500 ppm dietary Aroclor 1254 for 67 or 186 days prior to pair-mating for the Fl<sub>a</sub> and Fl<sub>b</sub> generations, respectively (Linder et al., 1974). The F0 rats received reported dosages of 0, 7.2 and 37.0 mg/kg-day and were sacrificed after a total exposure duration of 8 months for hematology, organ weight and liver histology evaluation. The study was terminated after the Fl<sub>b</sub> pups were weaned. Effects in the P1 rats included increased liver weight in both sexes greater than or equal to 7.2 mg/kg-day, increased relative testis weight (absolute weight unchanged) at 37.0 mg/kg-day, decreased body weight gain in both sexes at 37.0 mg/kg-day, and changes in hematological values (reduced hematocrit and hemoglobin in both sexes, increased total leukocytes with normal differential count in females) at 37.0 mg/kg-day. Specific information on liver pathology was not reported but degenerative changes similar to those found in the Kimbrough et al. (1972) subchronic study were indicated for both dosages. Effects on the offspring included reduced survival to weaning at 7.2 mg/kg-day (85.9 and 68.1% survival in Fl<sub>a</sub> and Fl<sub>b</sub> pups, respectively, compared with 95.5% in controls), and reduced litter size and number and 100% pup mortality by day 3 in Fl<sub>a</sub> rats at 37.0 mg/kg-day. The decreases in postnatal survival indicate that both dosages are FELs.

Groups of six to eleven female Wistar rats were fed 2.5, 26 or 269 ppm Aroclor 1254 in the diet during gestation and lactation (Overman et al., 1987). A control group was fed untreated diet that contained 0.02 ppm PCBs (i.e., no added PCBs). Using a rat food consumption factor of 0.05 kg food/kg body weight, the dosages are estimated to be 0.001, 0.13, 1.3 and 13.5 mg/kg-day. The following neurobehavioral endpoints were significantly delayed or reduced in the pups: appearance of the auditory startle response at 0.13 and 1.3 mg/kg-day at age 6 days (slightly delayed), development of righting ability at 1.3 mg/kg-day at days of age (slightly delayed) and performance on a motor coordination test at 1.3 mg/kg-day at age 7 and 8 days (slower performance). Grip strength and appearance of eye opening were not affected by exposure. Other effects attributable to exposure included increased relative liver weight in pups at weaning at greater than or equal to 1.3 mg/kg-day and reduced birth weight, 50% mortality by 2 days of age and retarded growth in pups at 13.5 mg/kg-day. There were no exposure-related effects on maternal weight gain, gestation length, litter size, pup sex ratios, number of live and dead pups or physical appearance, relative spleen and thymus weight or relative and absolute brain weight of pups. Brain PCB levels increased from birth to weaning in all groups. Based on the evidence for impaired motor coordination in developing infants the 0.13 and 1.3 mg/kg-day dosages are a NOAEL and LOAEL, respectively.

Dietary Aroclor 1254 was administered to groups of 4-10 female ICR mice in concentrations of 0, 1, 10 or 100 ppm from 90 days before mating through gestation day 18 (Welsch, 1985). The investigators estimated the dosages to be 0.125, 1.25 and 12.5 mg/kg-day. No developmental toxicity was observed as judged by number of litters, number of dead and reabsorbed fetuses, fetal weight, incidence of gross malformations or skeletal development. Fetuses were not examined for internal malformations. Maternal effects other than significantly increased relative liver weight at greater than or equal to

0.125 mg/kg-day were not observed. No developmental effects were observed in mice treated with the same doses of PCB only on gestation days 6-18. Based on the increased maternal liver weight the highest NOAEL is 12.5 mg/kg-day.

Groups of seven adult male New Zealand white rabbits were fed dietary Aroclor 1254 in reported estimated dosages of 0, 0.18, 0.92, 2.10 or 6.54 mg/kg-day for 8 weeks (Street and Sharma, 1975). Immunological testing was started after 4 weeks of treatment at which time the rabbits were immunized with injected SRBCs. No treatment-related changes in serum antibody titers to SRBC (hemolysin and hemagglutination) were observed. SRBC-induced increases in serum gamma-globulin were consistently but not statistically significantly decreased by exposure, and the number of globulin-producing cells in popliteal lymph nodes was significantly decreased at 0.92 and 6.54 mg/kg-day. Skin sensitivity to tuberculin was generally lower in the treated groups but none of the decreases were statistically significant. Marked histologic atrophy of the thymus cortex was observed at 0.18 mg/kg-day and higher dosages except 0.92 mg/kg-day. There were no treatment-related effects on leukocyte count, histology of the spleen, thymus, liver, kidneys or spleen, relative kidney or adrenal weight, terminal body weight or food consumption. Relative liver and spleen weights were significantly increased at greater than or equal to 2.10 mg/kg-day; the increase in liver weight was 74% at the highest dosage. The 0.18 mg/kg-day dosage is a LOAEL based on the thymic cortical atrophy.

Limited specific information is available on the oral absorption of Aroclor 1254. Pregnant ferrets that ingested a single oral dose of Aroclor 1254 (approximately 0.06 mg/kg) absorbed approximately 85% of the initial amount (Bleavins et al., 1984). Studies predominately of individual chlorobiphenyl congeners indicate, in general, that PCBs are readily and extensively absorbed by animals. These studies have found oral absorption efficiency on the order of 75 to >90% in rats, mice and monkeys (Albro and Fishbein, 1972; Allen et al., 1974; Tanabe et al., 1981; Clevenger et al., 1989). A study of a non-Aroclor 54% chlorine PCB mixture prepared by the investigators provides direct evidence of absorption of PCBs in humans after oral exposure (Buhler et al., 1988), and indirect evidence of oral absorption of PCBs by humans is available from studies of ingestion of contaminated fish by the general population (Schwartz et al., 1983; Kuwabara et al., 1979). There are no quantitative data regarding inhalation absorption of PCBs in humans but studies of workers exposed suggest that PCBs are well absorbed by the inhalation and dermal routes (Maroni et al., 1981a,b; Smith et al., 1982; Wolff, 1985). PCBs distribute preferentially to adipose tissue and concentrate in human breast milk due to its high fat content (Jacobson et al., 1984b; Ando et al., 1985).

The metabolism of PCBs following oral and parenteral administration in animals has been extensively studied and reviewed, but studies in animals following inhalation or dermal exposure are lacking (Sundstrom and Hutzinger, 1976; Safe, 1980; Sipes and Schnellmann, 1987). Information on metabolism of PCBs in humans is limited to occupationally exposed individuals whose intake is derived mainly from inhalation and dermal exposure (Jensen and Sundstrom, 1974; Wolff et al., 1982; Schnellmann et al., 1983; Safe et al., 1985; Fajt et al., 1989). In general, metabolism of PCBs depends on the number and position of the chlorine atoms on the phenyl ring of the constituent congeners (i.e., congener profile of the PCB mixture) and animal species. Although only limited data are available on metabolism of PCBs following inhalation exposure, there is no reason to suspect that PCBs are metabolized differently by this route.

Data exist on the in vitro hepatic metabolism and in vivo metabolic clearance of 2,2',3,3',6,6'-hexachlorobiphenyl and 4,4'-dichlorobiphenyl congeners in humans, monkeys, dogs and rats (Schnellmann et al., 1985). The hexachlorobiphenyl congener is a constituent of Aroclor 1254. For each congener, the Vmax values for metabolism in the monkey, dog and rat are consistent with the respective metabolic clearance values found in vivo.

Thus, the kinetic constants for PCB metabolism obtained from the dog, monkey and rat hepatic microsomal preparations were good predictors of in vivo metabolism and clearance for these congeners. In investigations directed at determining which species most accurately predicts the metabolism and disposition of PCBs in humans, the in vitro metabolism of these congeners was also studied using human liver microsomes (Schnellmann et al., 1983, 1984). Available data suggest that metabolism of PCBs in humans would most closely resemble that of the monkey and rat. For example, the in vitro apparent Km and Vmax are comparable between humans and monkeys. These studies show consistency between the in vitro and in vivo findings and collectively indicate that metabolism of the two congeners is similar in monkeys and humans.

#### I.A.5. CONFIDENCE IN THE ORAL RfD

Study -- Medium  
Data Base -- Medium  
RfD -- Medium

Confidence in the principal study is medium. Groups of 16 rhesus monkeys were tested at four dose levels and LOAEL was established on the basis of clinical signs and immunologic alterations. Data for female and male reproductive function and developmental data in a nonhuman primate species is taken from an unpublished study (Levinskas et al., 1984) which established a NOAEL for reproductive effects at 0.005 mg/kg-day. The Arnold study also included evaluation of reproductive function but the data have not been completely analyzed. Preliminary examination of the Arnold et al. data indicate that the LOAEL for female reproductive function may be 0.005 mg/kg-day. This inconsistency in effect levels for reproductive toxicity was viewed as a limitation to the data base. Furthermore, there is a limitation in the characterization of reproductive toxicology because results of an unpublished study have been considered. An extensive number of laboratory animal and human studies were available for review, including two-generation reproductive studies. The chronic, 2-year bioassays performed in F344 rats showed evidence of degenerative hepatocellular changes in addition to the neoplastic changes that were observed. Only limited assessment of nonhepatic changes were made. Human occupational and environmental data is available for commercial PCB mixtures in general but not specifically for Aroclor 1254. The data base is rated medium on the basis of these considerations. Overall confidence in the RfD is medium.

#### I.A.6. EPA DOCUMENTATION AND REVIEW OF THE ORAL RfD

Source Document -- This assessment is not presented in any existing U.S. EPA document.

Other EPA Documentation -- U.S. EPA, 1984, 1989, 1990

Agency Work Group Review -- 06/16/1993, 02/16/1994

Verification Date -- 02/16/1994



### I.A.7. EPA CONTACTS (ORAL RfD)

Please contact the IRIS Hotline for all questions concerning this assessment or IRIS, in general, at (301) 345-2870 (phone), (301) 345-2876 (FAX) or Hotline.IRIS@epamail.epa.gov (internet address).

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### I.B. REFERENCE CONCENTRATION FOR CHRONIC INHALATION EXPOSURE (RfC)

Substance Name -- Aroclor 1254  
CASRN -- 11097-69-1  
Primary Synonym -- PCBs, Polychlorinated Biphenyls

Not available at this time.

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## II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Aroclor 1254  
CASRN -- 11097-69-1  
Primary Synonym -- PCBs, Polychlorinated Biphenyls

This substance/agent has not undergone a complete evaluation and determination under US EPA's IRIS program for evidence of human carcinogenic potential.

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## VI. BIBLIOGRAPHY

Substance Name -- Aroclor 1254  
CASRN -- 11097-69-1  
Primary Synonym -- PCBs, Polychlorinated Biphenyls  
Last Revised -- 10/01/1994

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## **\_\_VI.B. INHALATION RfC REFERENCES**

None

## **\_\_VI.C. CARCINOGENICITY ASSESSMENT REFERENCES**

None

## **\_VII. REVISION HISTORY**

Substance Name -- Aroclor 1254  
CASRN -- 11097-69-1  
Primary Synonym -- PCBs, Polychlorinated Biphenyls

Date	Section	Description
07/01/1993	I.A.	Oral RfD now under review
09/01/1993	All	Minor edit
03/01/1994	I.A.	Work group review date added
10/01/1994	I.A.	Oral RfD summary on-line
10/01/1994	VI.A.	Oral RfD references on-line
11/01/1996	I.A.7.	Primary contact's office changed
04/01/1997	III., IV., V.	Drinking Water Health Advisories, EPA Regulatory Actions, Supplementary Data were removed from IRIS on or before Apr 1997. IRIS users were directed to the appropriate EPA Program Offices for this information.

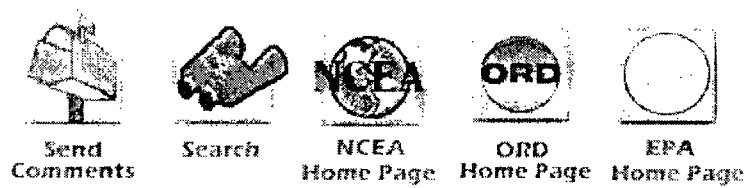
## **VIII. SYNONYMS**

Substance Name -- Aroclor 1254  
CASRN -- 11097-69-1  
Primary Synonym -- PCBs, Polychlorinated Biphenyls  
Last Revised -- 07/01/1993

11097-69-1  
Aroclor 1254  
Arochlor 1254  
CHLORIERTE BIPHENYLE, CHLORGEHALT 54% [German]  
CLORODIFENILI, CLORO 54% [Italian]  
DIPHENYLE CHLORE, 54% DE CHLORE [French]  
HSDB 6357  
NCI-C02664







Last updated: 5 May 1998  
URL: <http://www.epa.gov/iris/subst/0389.htm>

U# 5ms = marine stand.